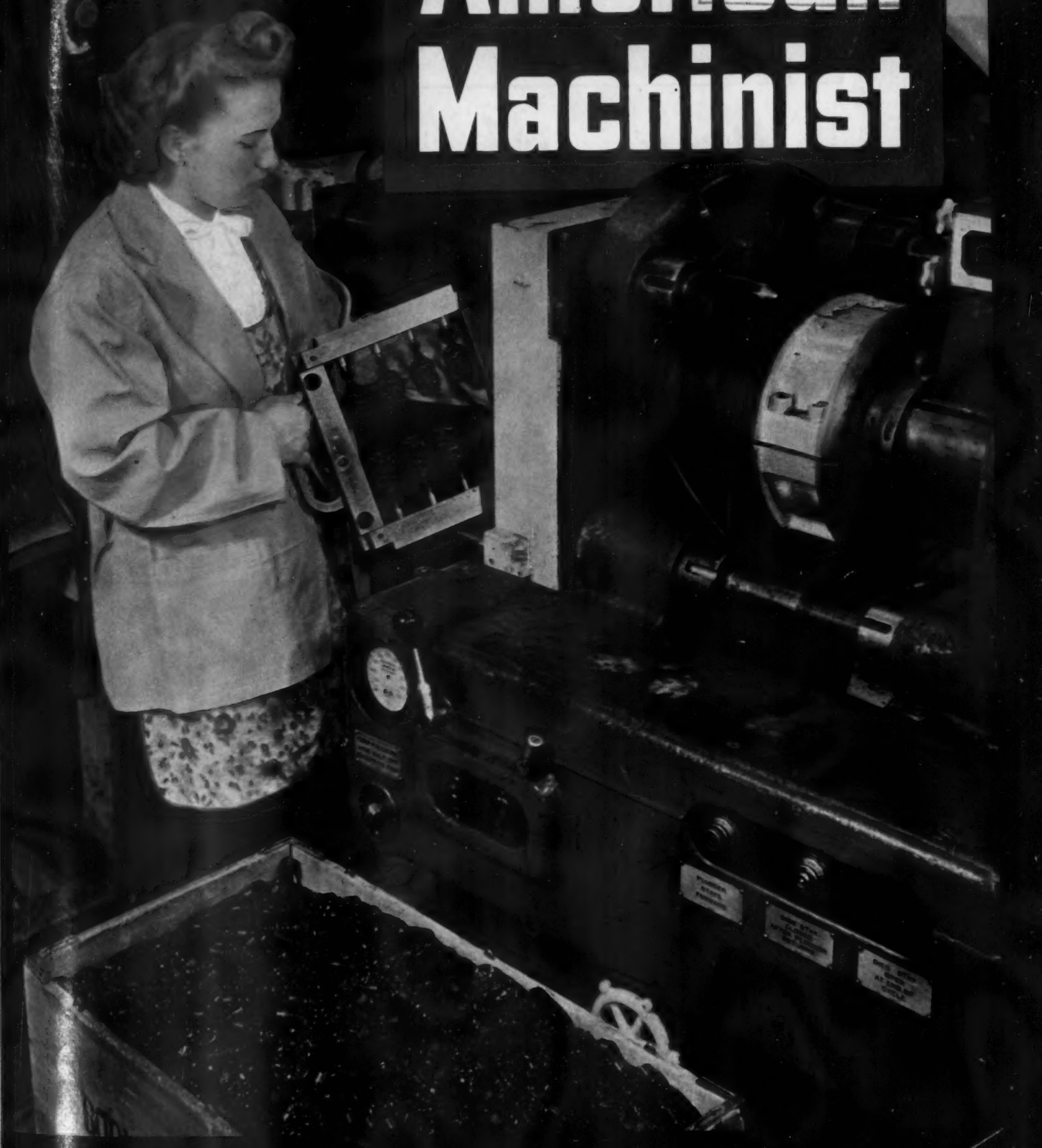
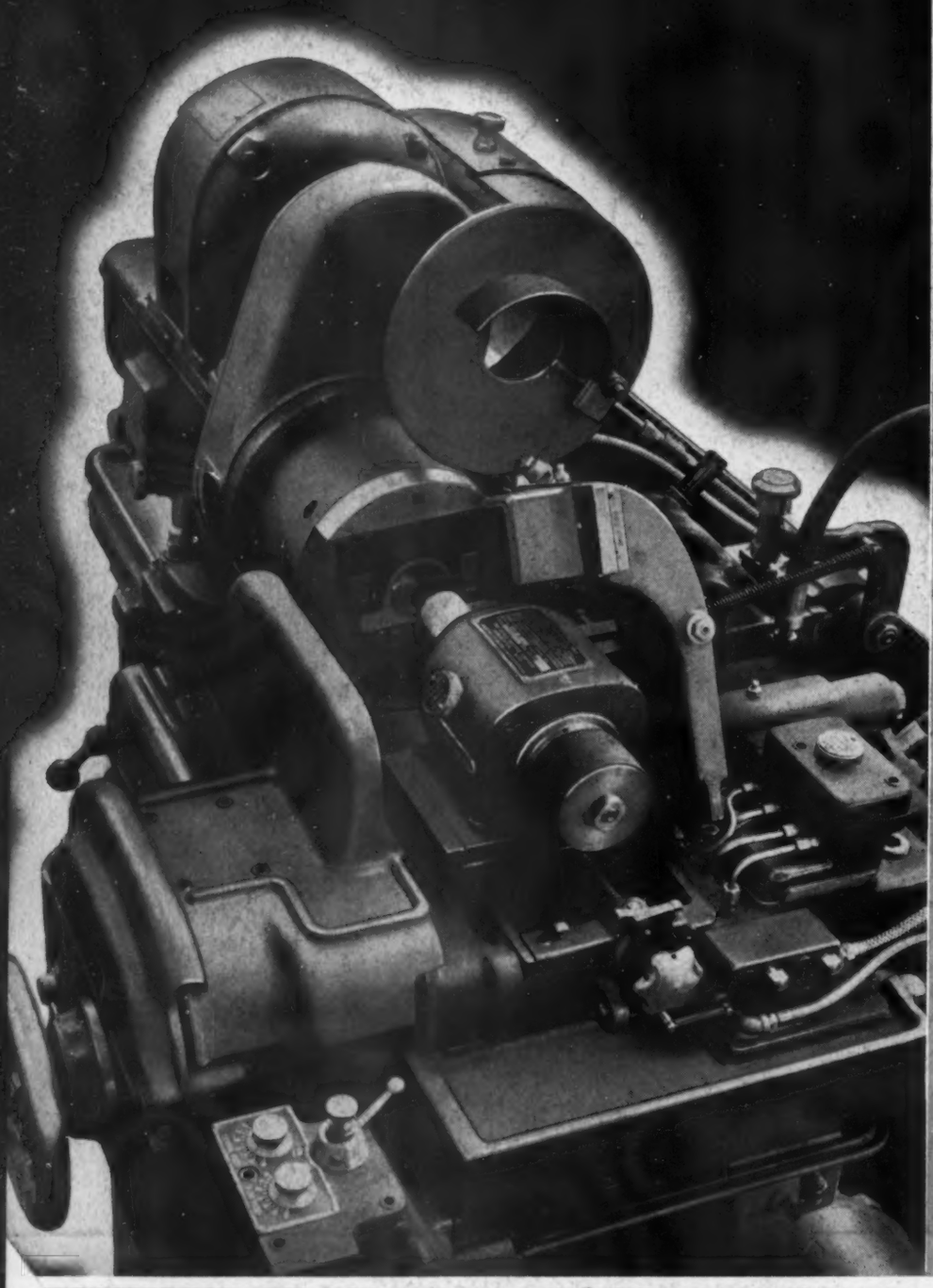
APRIL 11, 1946

American Machinist



Featuring HOW TO WORK WITH PLASTICS

Why we wouldn't sell the customer more than *ONE* machine



Another example of how Heald Engineering cuts production and equipment costs

Yes—we actually made it possible for one machine to handle the job, although the customer thought he wanted two! Here's his original inquiry:

"Please forward proposal and quotation covering one Heald No. 81 Size-Matic Internal Grinder for grinding inside diameter . . . also, proposal and quotation on a suitable grinder for grinding bottom of same part." That looked like an order—for two machines. But Heald engineers had a better answer. They knew that with special arrangement one Size-Matic could handle *both those grinding jobs at once!*

Result? The manufacturer made an immediate saving of about 50% on equipment . . . reduced his space and manpower requirements . . . and substantially cut his production costs.

It is engineering like this which can easily mean the difference between profit and loss on any production line, especially in these days when so many other factors may be beyond control. Whether your plant operation involves high speed mass production requiring hundreds of workers, or whether you operate a small shop employing only a handful, Heald engineers will be glad to study your production with an eye to cutting costs. There's no obligation, of course. For further details, write: THE HEALD MACHINE COMPANY, Worcester 6, Mass.

HEALD

means finer precision . . . lower costs

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MAGAZINE OF METALWORKING PRODUCTION

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Chips and QUIPS

Injection Molding . . . Our cover Kodachrome, taken at Boonton (N. J.) Molding Company by McGraw-Hill Studios, pictures injection molding of cellulose-acetate lamp-shade finials on a Reed-Prentice machine.

Success Formula . . . If you want your son to be a president of the United States, name him whatever you like; if you want him to be president of a large industrial concern, name him Charles E. Wilson. As far as we know, there are three of the latter: Charles Erwin Wilson of General Motors, Charles Edward Wilson of General Electric, and the recently named Charles Eben Wilson of the Worthington-Gamon Meter Company.

Vets Return . . . With the re-addition of Andy Ashburn to the editorial staff, we have six wearers of the "duck," including three Navy officers, an Army officer, a Wave officer, and a Wac. We're all saying "Sir" just to play safe.

Plastics How To . . . Our ubiquitous Harold Flynn turns up again, this time giving the lowdown on plastic processing from mold design and material selection to finishing. This is Hal's bailiwick—he was formerly editor of *Canadian Plastics*. He proved it by consulting everybody within range and distilling their experience into 20 fact-packed pages.

20 Pages . . . Back in December, we arbitrarily added 8 editorial pages to every issue. But our stainless-steel (Feb. 28) and plastics reports each required four pages over budget. The News went over for four pages Feb. 28 too, and in this issue is the second of our 2-page manufacturers' literature inserts. Net bonus thus far: 16 pages. That's why editors are in a constant mad rush.

O, O, Ober Cost . . . Apparently, plant cost men are partial to surnames with an initial O. On Feb. 14, we published the ideas of a prominent East Coast accountant, G. J. Oberst, of Elastic Stop Nut. In this issue, we print those of a similarly prominent West Coast planner, David P. Oberg. It's another case of simultaneous invention; they and we had the idea simultaneously that costs are vital in postwar operation of older plants as well as to the veteran coming back to start his own new one.

Photogenic Editor . . . We're in receipt of a thank-you note from the chief, Visual Education Section, Federal Security Agency, U. S. Office of Education. Accompanying it are copies of several of the instructor's manuals from the Machine Shop Work Series issued by the Section during the war. They were part of film kits showing operations on the milling and grinding machines. Operator of the miller in these films is W. J. Hargest, associate editor, now in London. Sort of an editorial version of the doctor taking his own medicine.

Tip to Export Sellers . . . Americans, proud of their homeland's mechanical progress, oversell it in South America. Customers down there don't like to be told: "That's not the way. Now, in Podunk, we do it this way . . ." According to our informant, the British are much smarter; they don't make that discourteous mistake.

Coming in Our Next . . . How Kearney & Trecker controls carbide, cutter design and applications, Kellett's grievance procedure, Crocker-Wheeler's cost-saving tool-control system . . . A special report titled: "Needed—A Sensible Depreciation Policy." Another important subject scheduled involves careful tool layouts for shortening screw-machine cycles.

CHANGE OF ADDRESS

Director of Circulation
AMERICAN MACHINIST, 330 West 42 Street, New York 18, N. Y.
Please change the address of my American Machinist subscription.

Name _____

Old Address _____

New Address _____

New Company Connection _____

New Title or Position _____

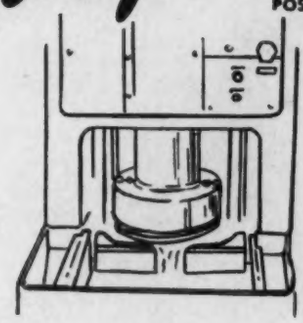
PORTRAIT OF THE WEEK

Wrote David P. Oberg: "For the past eight years, I have been a subscriber to *American Machinist* . . . Material has covered a wide field. However one type of article I have never seen in this publication or any other . . ." The result: The lead in this issue. A graduate of San Jose (Calif.) College, Mr. Oberg started with American Can as an apprentice machinist in 1935, was transferred to Planning in 1939. In 1938, he won an award in the Lincoln Arc Welding Contest, belongs to ASME, ASTE and ASM.

Check These Advantages

QUICK SET-UPS

POSITIVE CONTROL OF THE WORK



METALLURGICALLY CORRECT OIL FLOW

SAFE, EASY METHOD OF QUENCHING

GLEASON
NO. 16 QUENCHING PRESS

POSITIVE CONTROL OF THE WORK

Work is clamped against distortion on a fixed lower die . . . quenching oil uniformly being forced over and around the part . . . result: a true round flat shape.

METALLURGICALLY CORRECT OIL FLOW

All controls are adjusted from front of machine. At all stages of the quenching operation the volumes and rates of flow of the oil are pre-set to assure uniform hardness and minimum distortion.

QUICK SET-UPS

Removable upper die can be changed easily and quickly to suit each different job . . . upper die drops out on lower die and is easily removed when lower die is swung out to loading position.

SAFE, EASY METHOD OF QUENCHING

The lower die automatically swings out from under upper die for a safe, quick means of loading and unloading the work. Once set up, one control switch sends this machine through an entire quenching cycle, returning it to loading position when completed.

Write for descriptive leaflet . . . send in blueprints . . . let us show you how the new Gleason No. 16 Quenching Press will solve your quenching problems.

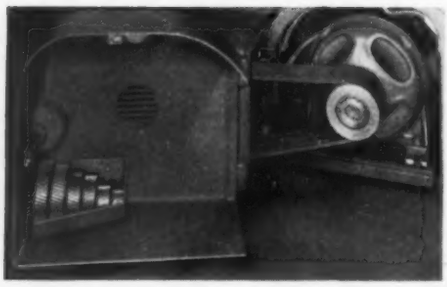
GLEASON Works
Builders of BEVEL GEAR MACHINERY
FOR OVER EIGHTY YEARS

1000 UNIVERSITY AVENUE, ROCHESTER 3, NEW YORK

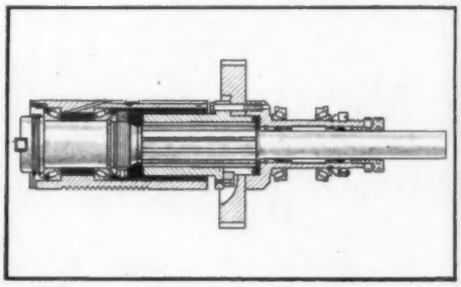
The New, Heavier and More Powerful

CINCINNATI HYDROMATIC MILLING MACHINES

offer all these features...



The new CINCINNATI Hydromatic has plenty of power . . . motors up to 30 h.p. in standard machines . . . depending upon the size and type, and larger motors will be furnished if desired. V-belts are used to assure quiet, smooth operation.



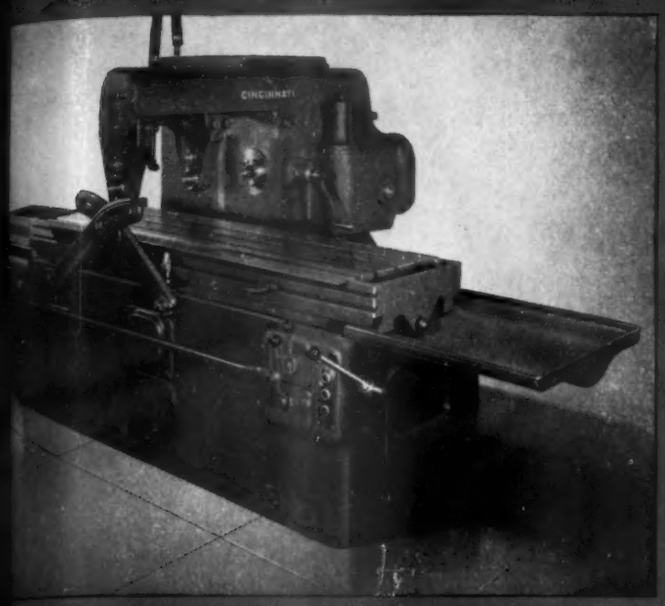
You will notice from the sketch above that the spindle of the new Hydromatic is extra large, and mounted on four anti-friction bearings. The spindle drive is simple, powerful and decidedly efficient, having only four gear contacts.

New CINCINNATI Hydromatic Milling Machines are especially adaptable to operations requiring heavy cuts and rapid metal removal on all types of metals, using sintered carbide as well as high speed steel cutters. These new machines are built in twelve sizes, in Plain and Duplex styles, ranging from 24" to 90" table travels, powered by 7½ to 30 h. p. motors, and higher if desired. You'll find complete details of these machines, their features and benefits, in specification Catalog M-1372. Write for your copy today.

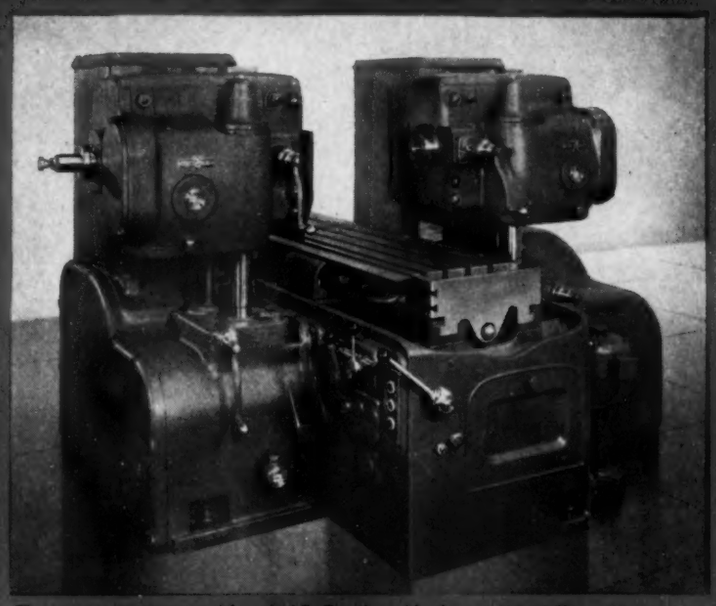
CINCINNATI

THE CINCINNA

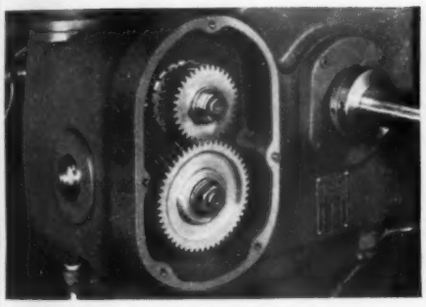
MILLING MA



The new CINCINNATI No. 5-60 Plain Hydromatic Milling Machine. Catalog M-1372 contains specifications for both the Plain and Duplex styles.



The new CINCINNATI No. 4-48 Duplex Hydromatic Milling Machine. Sweet's Catalog File for Mechanical Industries gives a brief description of the Plain and Duplex machines.



These Wide-Faced Helical Pick-off Gears are indicative of the power which can be transmitted to the spindle. You have a choice of *seven* spindle speed ranges; pick-off gears provide eight speeds in each range.

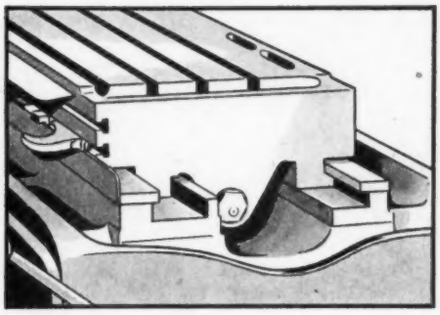
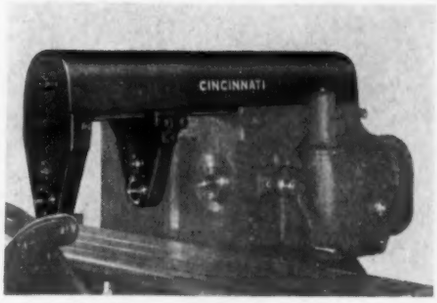


Table is exceptionally heavy. Ways have Square Gibbed Bearings. This construction adds to the smoothness of table traverse when taking high speed carbide cuts, or wide, deep cuts at a low cutting speed. Also improves accuracy.



The rectangular overarm, a well-known CINCINNATI feature, is exceptionally heavy. A built-in vibration damper gives it added effectiveness in providing a rigid, stable support at the outer end of the arbor.

● In addition to the features shown, the new CINCINNATI Hydromatic Milling Machines have: 1) Hydraulically Actuated Table Traverse with Cincinnati Locked Hydraulic Feed. 2) Automatic Table Feed Cycles, with power rapid traverse to quickly bring cutter to work. 3) Infinite Number of Table Feed Rates. 4) Automatic Change of Feed Rates. 5) Conveniently Grouped Controls at the operator's normal working position. Electrical control buttons are built in, next to the operating levers. 6) Single Four-Position Lever for complete table control. 7) Coolant Automatically Starts and Stops with Spindle Rotation. 8) Spindle Drive Gears are Helical and Spiral Bevel. 9) Improved Chip Collection and Coolant Control. 10) Automatic Lubrication with Low-Level Cut-Out. 11) Built-in Leveling Jacks. 12) Spindle Speed Change Gears Stored in Motor Compartment Cover. ¶ These and many more features are a part of the new CINCINNATI Hydromatic Milling Machines. Write for complete description and engineering specifications.

ILLING MACHINE CO. CINCINNATI 9, OHIO, U.S.A.

BROACHING MACHINES • CUTTER SHARPENING MACHINES

you wouldn't

buy a horse with [illegible]

than he could carry . . .

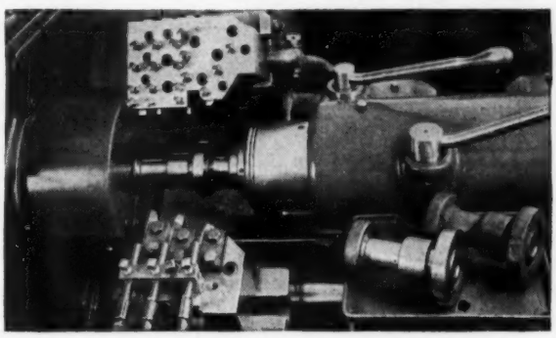
Nor should you put carbide cutting tools on a lathe lacking the fundamental rigidity for their most efficient use. Carbide cutting tools have increased horsepower requirements up to 300 per cent. They have increased cutting speeds 200 to 500 per cent.

Our jobs, our earnings and profits as well, will depend upon low cost production in the terrific competition to come. The most modern machines and methods must be used.

Now is the time to scrap the machines that cannot "carry the load," and replace them with good War Surplus machines or new machines. 'Phone now for one of our engineers to help you to select the equipment best suited to your needs.

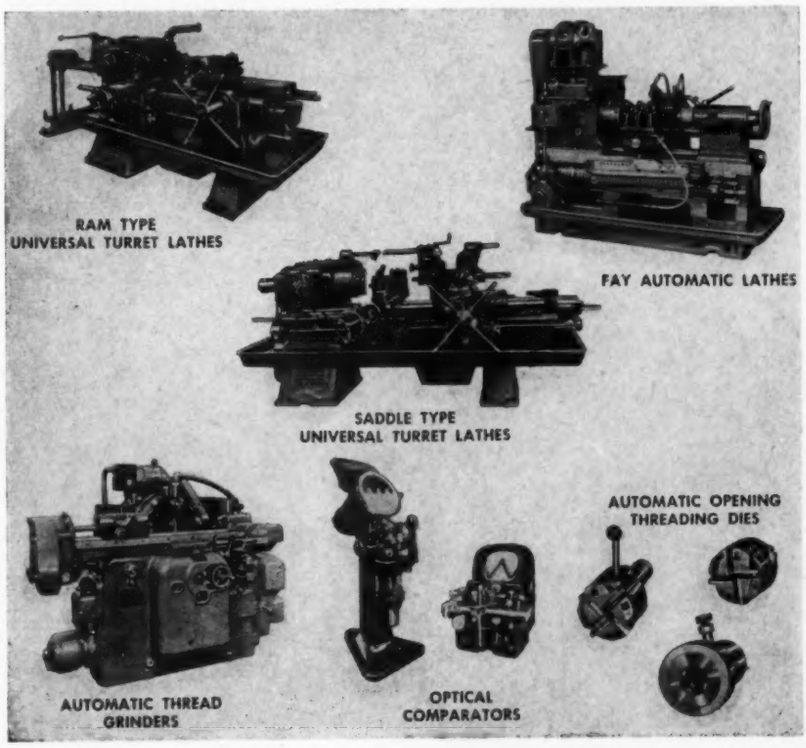
What Horsepower Are YOU Using?

45 to 50 horsepower is required to rough turn and face these automobile transmission cluster gears, at the high surface speeds required by carbide cutting tools—this is approximately three times the horsepower needed with high speed steel cutting tools. Fay Automatic Lathes are designed for the most efficient use of carbide cutting tools.



Engineered to "Carry the Load" for Most Productive Operation With Carbide Cutting Tools

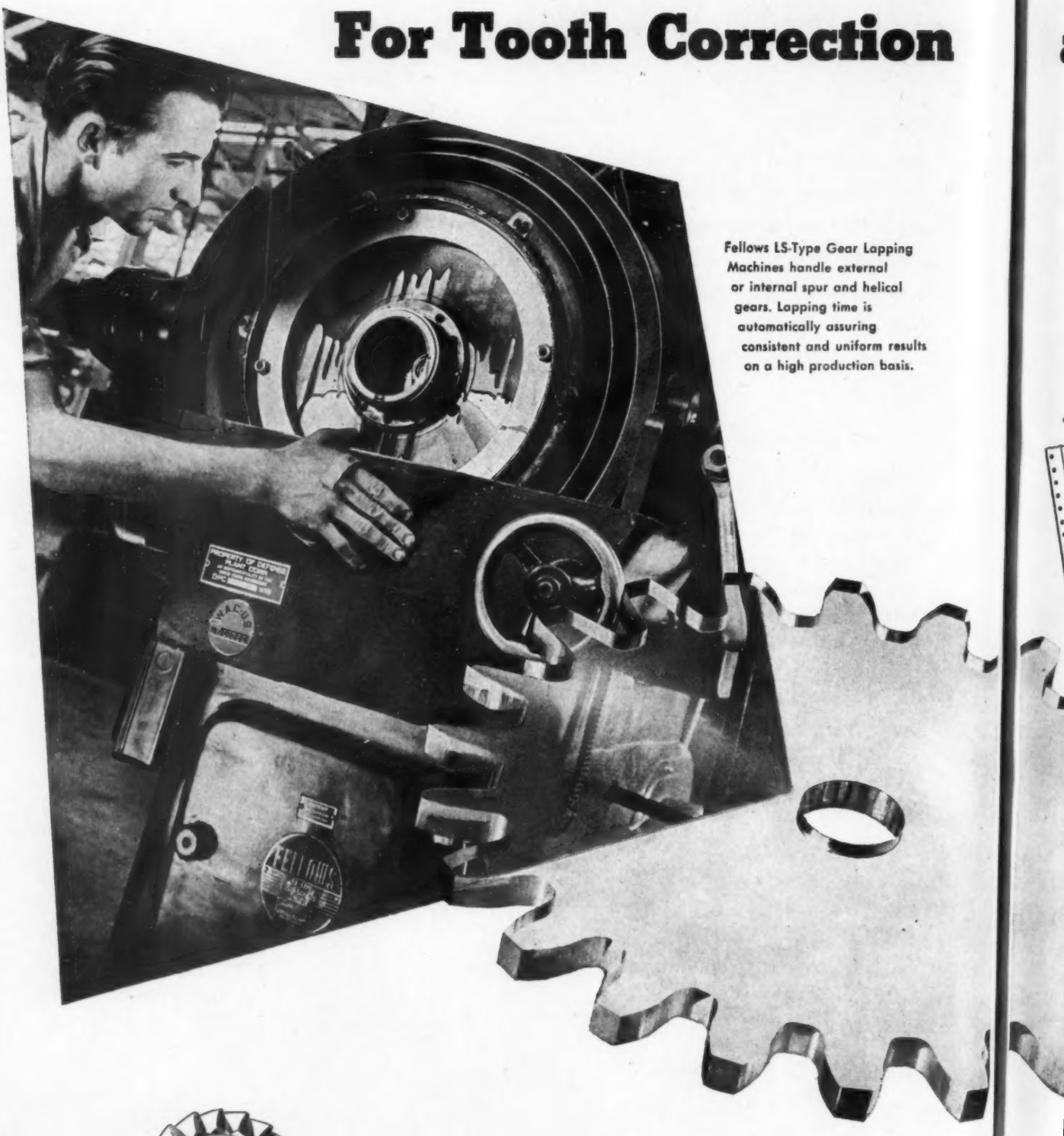
Fay Automatic Lathes



JONES & LAMSON
MACHINE COMPANY
SPRINGFIELD, VERMONT, U. S. A.

Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.

For Tooth Correction

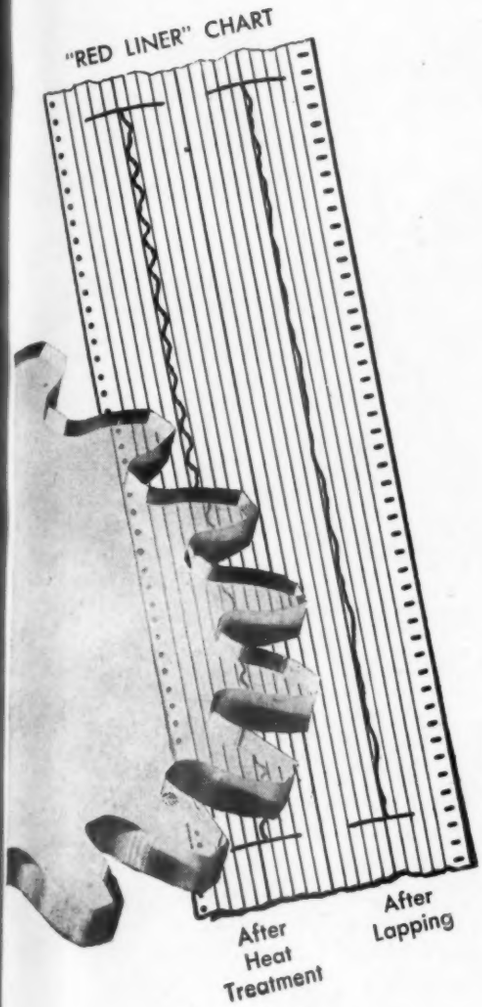


Fellows LS-Type Gear Lapping Machines handle external or internal spur and helical gears. Lapping time is automatically assuring consistent and uniform results on a high production basis.

THE FELLOWS METHOD... MACHINES AND TOOLS FOR AL

after Hardening...

Lapping!



The Fellows Method of gear lapping has proven both practical, and economical as a means for finishing hardened gears. War-time experience in the lapping of intricate gear shapes has demonstrated beyond all doubt the practicability of this method.

As indicated by this RED LINER chart minor tooth inaccuracies are removed by lapping. Careful attention to design and heat treatment, combined with lapping after hardening produces a superior product at lower costs than can be obtained by any other method.

Our engineers will be glad to place the company's experience at your disposal, if you are interested. For the ultimate in finely finished accurate tooth surface Fellows Lapping is a notable advantage.

Write: The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Bldg., Detroit—or 1040 West Town Office Bldg., Chicago.

Fellows

ALL OPERATIONS FROM BLANK TO FINISHED GEAR

Introducing the Features

OF THE

CINCINNATI FILMATIC 14"-L PLAIN HYDRAULIC GRINDING MACHINE

CINCINNATI FILMATIC 14"-L Plain Hydraulic Grinding Machine. For precision grinding operations on parts within the 10" machine range, but requiring a larger swing. Built in five between-center lengths, from 18" to 96".

● Like other machines in Cincinnati's line of five precision Plain Hydraulic Grinders, the 14"-L size, recently announced, has many features which contribute to low cost production of high quality work. Take *FILMATIC Spindle Bearings,* for example. In eliminating "flutter" and "pecking" of the diamond, quality of finish goes up. And having a much longer life than spindle bearings in any other make of centertype grinder, maintenance costs shrink to the vanishing point. Suppose we consider another point—*Automatic Filtered Pressure Lubrication* of table ways and cross ways. This feature assures smooth traverse, and consequently better finish on the work. It also eliminates costly rescraping bills, because there's no wear in the ways. ¶ The 14"-L's have many other noteworthy features shown on the opposite page. For complete specifications, write for publication G-533.

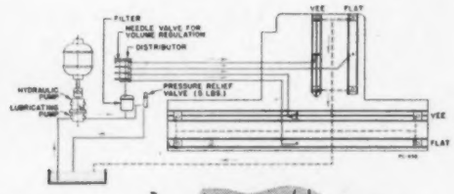
CINCINNATI

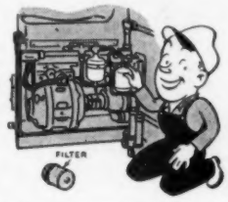
CINCINNATI GR

CENTER TYPE GRINDING MACHIN

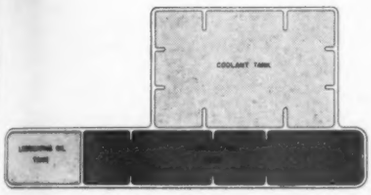
● Assembling the segments of FILMATIC Bearings. FILMATIC, an exclusive bearing in CINCINNATI Grinding Machines, produces exceptionally fine finishes and never requires maintenance. FILMATIC Bearings are self-adjusting, and they eliminate spindle flutter and are practically foolproof.

● Both ends of the table ways are protected by close-fitting telescopic guards. This feature contributes to low maintenance and long life span because it prevents dust, grit and other harmful substances from settling on the table ways. Protection of the cross ways is provided by a hinged guard at the front of the wheel head unit.

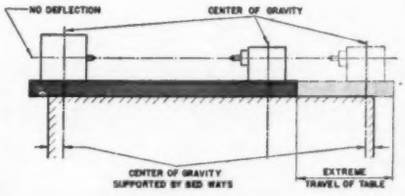




● Diagram above shows system of lubricating ways. Sketch at right illustrates how easy it is to replace filters. Flow and pressure valves are also accessible here. Automatic Filtered Pressure Lubrication for table ways and cross ways adds to smoothness of traverse, helps keep down maintenance costs, and increases useful life span of the machine.

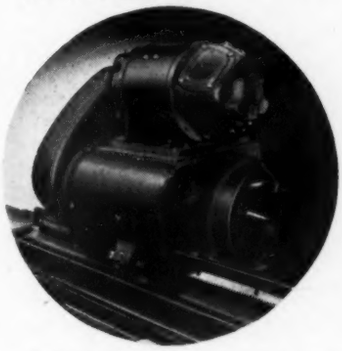


● Individual hydraulic and lubricating oil reservoirs are cast in the bed, next to the coolant reservoir. Heat remaining in the oil when it returns to the reservoirs is readily dissipated through a separating wall to the coolant. Uniform temperature means stability of alignments and closer accuracy.



BED OF PROPER LENGTH

● Cincinnati Bed is a heavy casting, with correct metal distribution. With the headstock and footstock at ends of table, and table traversing its maximum stroke, center of gravity of both units is supported by bed ways. There is no deflection, and long work may be ground as accurately as short work.



● V-belts drive the headstock from a motor mounted on top of the unit. There are no gears or chains in the headstock drive. This means an extremely smooth transmission of power, one of the factors in obtaining high finishes.

● In addition to the features enumerated above, CINCINNATI 14″-L Grinding Machines have: 1) Single Lever Start-Stop of Coolant Flow, Work Rotation and Table Traverse. This means less fatigue in operation of the machine. 2) Lever and Handwheel Retraction of Footstock Center. 3) Hand-Set Table Dogs—no wrenches are required. You'll find this reduces set-up time. 4) Exceptionally Accurate Movement of Wheel Head Cross Slide . . . your assurance of accuracy in sizing adjustments. 5) Infinitely Variable Table Traverse Speeds, 3″ to 220″ per minute—a sufficient range for truing the wheel and traverse grinding at any practical rate. 6) Independent Right- and Left-Hand Tarry Adjustments. These adjustments aid finish and sizing at ends of taper work and when grinding next to shoulders. 7) Servo Hand Table Traverse (with drag adjustment for "feel")—hydraulic power does all the work of moving the table by hand. 8) Infinitely Variable Work Speeds. The right speed for every job is instantly available. 9) Accuracy of Table Reversal with power traverse engaged, within .004″. This permits table traverse to be used when grinding close to shoulders. Less work spoilage. ¶ A detailed description of all the features of CINCINNATI 14″-L Plain Hydraulic Grinding Machines and their benefits to you, are contained in Catalog G-533. Write today for your copy of this publication.

AT GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CHIN NTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

Buying and Using Van Norman Milling Machines Available in U. S. Government Surplus Stock

Van Norman is vitally interested in assisting you in acquiring and obtaining maximum satisfactory use from Milling Machines of our manufacture which are available in U. S. Government surplus stock.

When considering the purchase of such surplus equipment, Van Norman will gladly help you by supplying information, specifications and other assistance which will enable you to select the proper model and type of milling machine *best* suited for your needs. Simply call on us or the nearest dealer listed below.

If you have purchased a Van Norman Miller from U. S. Government surplus stock and need assistance in getting maximum efficiency of operation from your equipment, Van Norman is eager to serve you with its service facilities.

The majority of the available Government surplus machines have thousands of hours of satisfactory performance still remaining, in spite of war years of severe use. These can be purchased by you at fair and reasonable prices.

In determining how these available machines fit into your shop facilities program, you will, of course, want to consider that some of these machines have now been superseded by new improved models, while others have had important new features incorporated in their design which add to their efficiency of operation. Van Norman will gladly offer you suggestions to guide you in determining whether Government surplus, or our latest equipment, will best serve your particular purpose.

Regardless of whether you require Government surplus machines, or new machines, it is to our common interest that you get full satisfaction from the Van Norman equipment installed in your shop.

VAN NORMAN COMPANY

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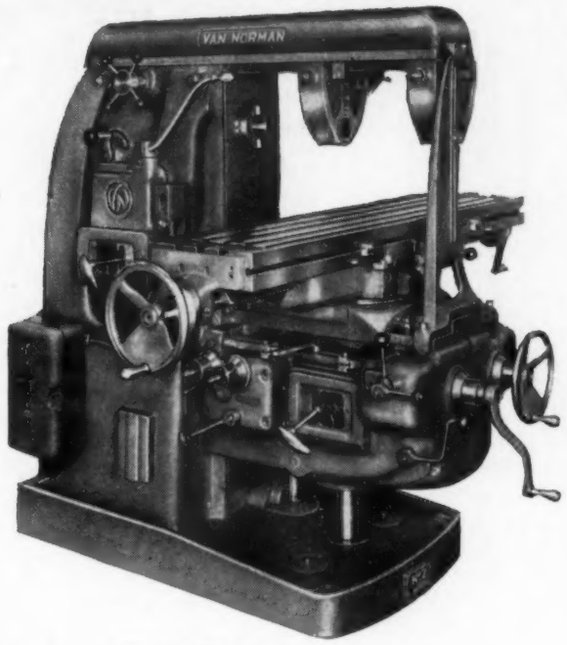
"It Pays to

A New Van Norman Horizontal Milling Machine



No. 2 Heavy

FEATURING...

- ***BUILT-IN SPINDLE FLYWHEEL FOR BETTER CUTABILITY***
- ***FRONT AND REAR CONTROLS FOR EASE OF OPERATION***
- ***HEAVY DUTY SPINDLE TRANSMISSION FOR POWER***

Investigate the new Van Norman No. 2 Heavy horizontal milling machine. It is available with a plain or universal saddle. Write for complete information, today.

VAN NORMAN FEATURES THAT PAY-OFF IN PROFITS

★ Heavy Spindle Flywheel, mounted inside a sturdy column, increases cutting range, assures smooth work finish.

★ Front and Rear directional Controls of all power feeds, six-way rapid traverse and hand adjustments provide convenience of control and maximum operator safety from front or rear operating positions.

★ Single lever Feed and Speed Selectors provide quick selection of 18 feeds and 18 speeds.

★ Hardened Alloy Steel Gears with greater tooth area and taper roller bearings mounted on multi-splined shafts assure long wearing life.

★ Overarm Pilot Wheel permits easy positioning of the heavy over-arm.

★ Large easy-to-read Dials permit accurate hand adjustments.

★ Automatic Lubrication assures proper oiling of all operating parts.

★ 58 x 13-inch table provides ample surface for wide range of work.

Van Normanize"

An Ideal Threading Combination

. . The LANDMACO For Large Precision Work

. . The 3/8" HIGH SPEED For Small Parts

For manufacturers of screw machine products and other small threaded components, the efficiency of this combination is clearly demonstrated by the production records of the machines illustrated. Threading 5/8" diameter 24 pitch threads to class three specifications, the LANDMACO Machine produces 600 pieces per hour. On some smaller threaded parts made from brass the 3/8" High Speed Machine has produced as high as 60,000 pieces per grind of the chasers.

Such performance assures lowest possible threading costs. It warrants your investigation in handling your threading operations.

Write for Bulletin No. H-91

MACHINE CO. WAYNESBORO PENNA. U.S.A.

The ⅜" Threading Machine and the LANDMACO Threading Machine are equipped with the LANCO Head which employs the LANDIS Long Life Tangential Chaser.

This cranberry fork is made by Wisconsin Cranberry Sales Co.

But it certainly takes punishment when the pickers get to swinging

The job's a cinch as long as the cranberry fork swishes *freely* through the bushes, gathering berries at every swing. But it strikes snags and stones a'plenty in its busy life, and that's when the toughness of its American Magnesium forged tines counts.

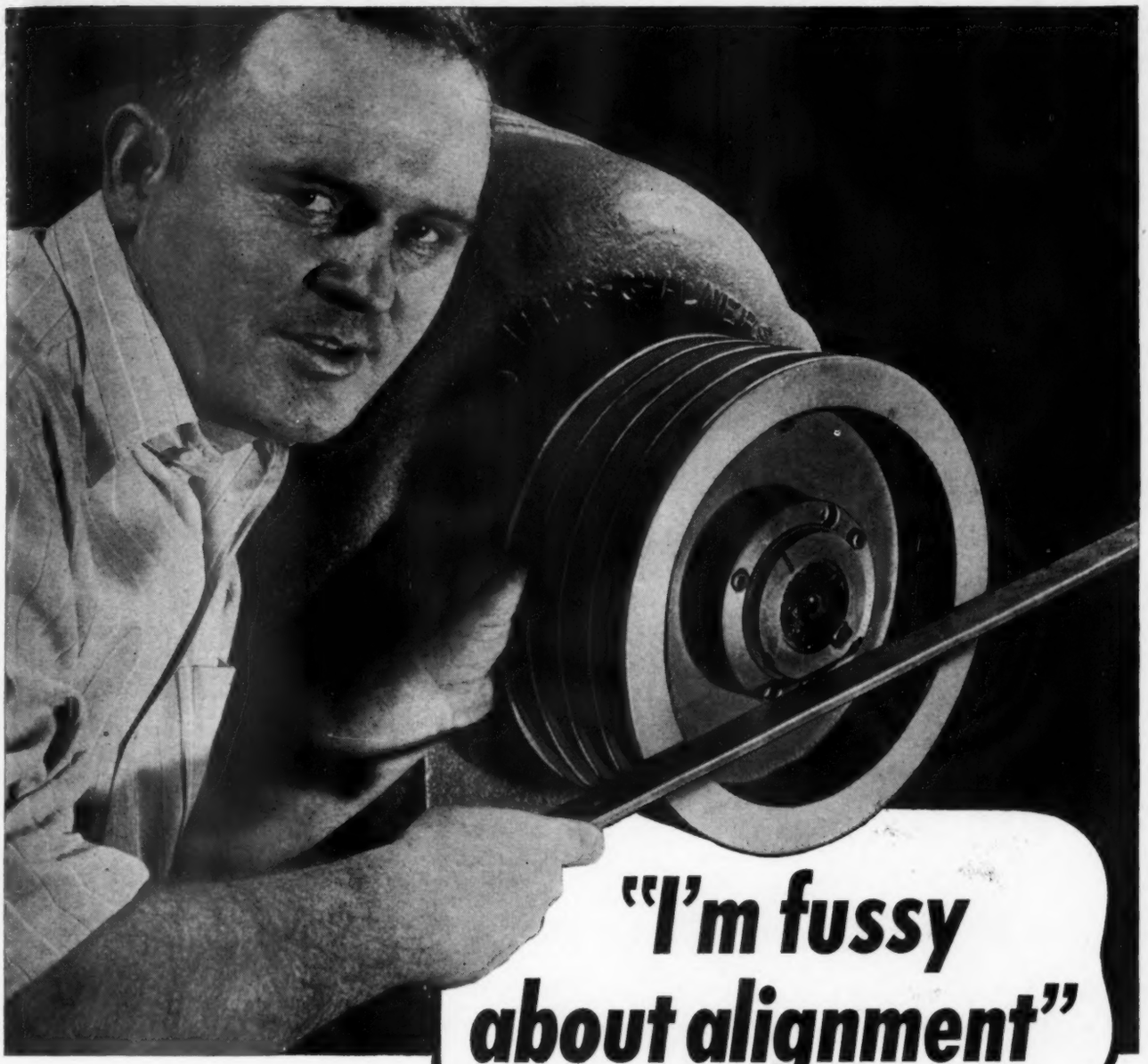
The lightness of those tines is especially important here, too. Imagine having to swing, all day long, a picker made of *heavy* metals!

Doubtless, many of your products—those that move or have to be moved—can be improved by making them lighter with magnesium. Our engineers will help you work it into your designs. And American Magnesium can supply you with magnesium parts in every form. Call the nearest office of Aluminum Company of America, Sales Agent for American Magnesium Products. Or write to Alcoa, 1709 Gulf Building, Pittsburgh 19, Pa.

MAGNESIUM MAZLO PRODUCTS

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA



"I'm fussy about alignment"

TEXROPE "MAGIC-GRIP" SHEAVES make the job easy!

JUST slide it on the shaft — move it into exact alignment, using a straightedge if desired — then tighten three cap screws. It's easy as that.

Sheave and bushing come completely assembled. No hammering, no filing or reaming. The patented "Magic-Grip" Sheave gives a powerful clamp fit without backlash, shear or wobble. Yet it can be taken off as easily as it goes on.

You save manhours and money the first time you mount a Texrope "Magic-Grip" sheave — and every time after. In addition, there are no set screws to score shaft. And because you don't *hammer* it on, you can't damage motor bearings!

These advantages cost you nothing extra. For details call your A-C office or dealer, or write for Bulletin B6310. ALLIS-CHALMERS, MILWAUKEE.

V-BELTS

TEXROPE complete line — Sizes, types for every power transmission problem and condition.

ALLIS CHALMERS

TEXROPE V-BELT DRIVES

ORIGINATORS OF THE MULTIPLE V-BELT DRIVE

SHEAVES

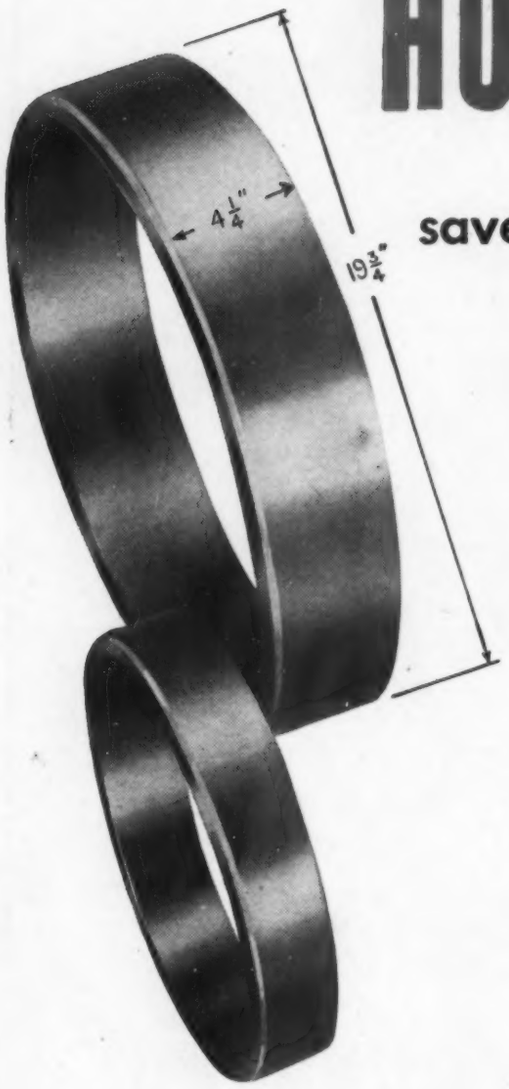
"MAGIC-GRIP" . . . TEX-STEEL . . . TEXDRIVE . . . Speed changers and VARI-PITCH sheaves.

HEAR THE BOSTON SYMPHONY: *Every Saturday Evening, American Broadcasting Co.*

A 2008

HOW A MODIFIED

saved the cost of a special machine



STOCK REMOVAL .028"
+.000"
—.001"

Here is a grinding problem that was solved at a saving of time and money. The modified standard machine recommended for the job permitted much faster delivery. The relatively few modifications needed saved the expense of a custom built machine.

The job of grinding outside diameters of roller bearing races up to 27" diameter would ordinarily require a special machine because the work diameter was too large for standard machines.

The problem was put before the Landis Tool grinding engineers. Outside diameters were to be ground ranging from 19¾" to 27"; stock removal .028"; tolerance + .000" — .001". They knew that the 18" Type C Hydraulic Universal was the largest standard universal grinder in the line that would handle the job, but it could handle work up to 18" diameter only, while the demands of the job were almost twice as great.

To raise the swing from 18" to 30" with a new headstock and footstock was relatively simple. The only other changes necessary were modifications in the slide for the wheelbase and the wheel feed equipment—both to accommodate the larger diameter.

Other grinding problems have frequently been solved by Landis Tool engineers by a standard machine with special tooling. Regardless of whether your grinding problem is simple or complex, it will get the most practical and lowest cost solution.

Write us the details of your problem and ask for Engineered Grinding Service. 48

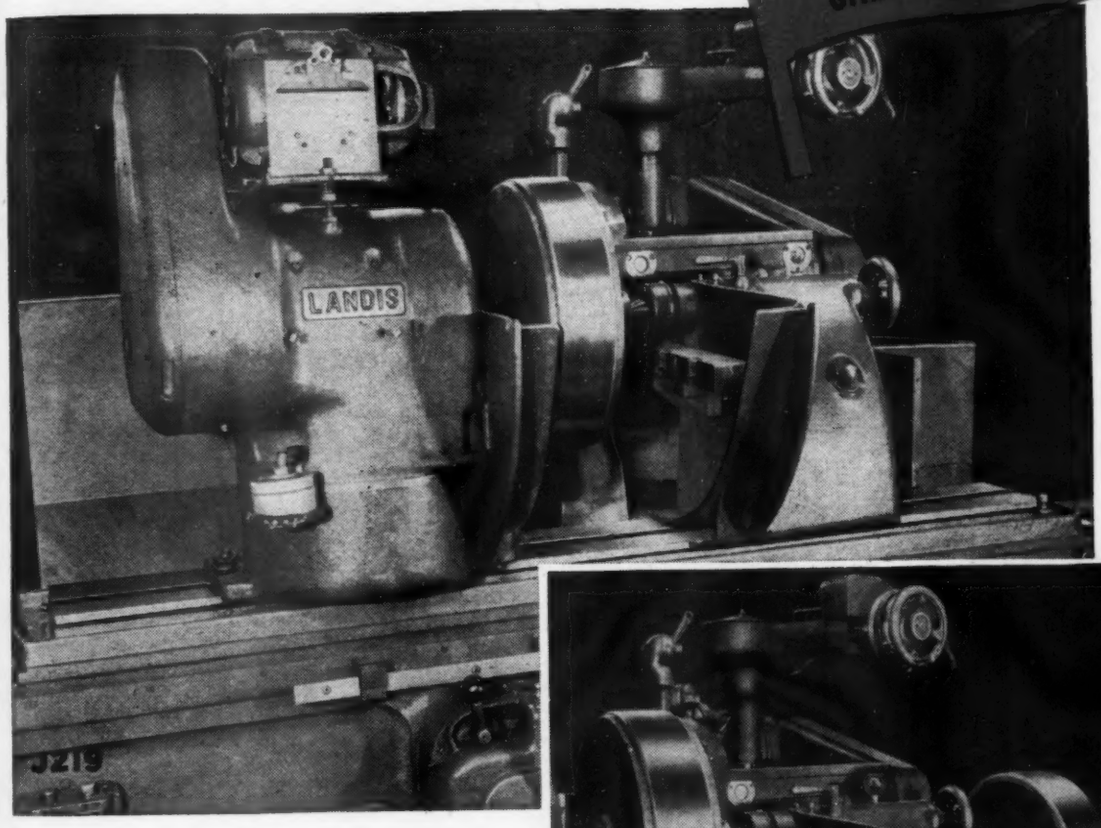
LANDIS TOOL
Precision Grinders

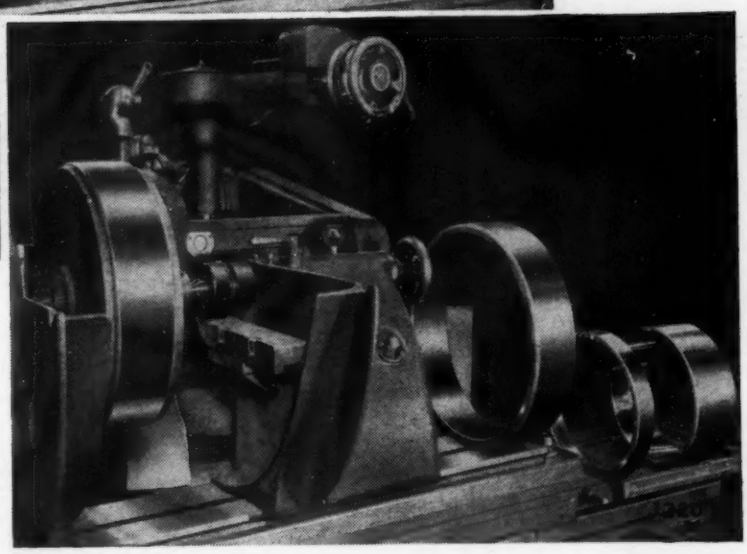
LANDIS TOOL COMPANY

STANDARD GRINDER

for 27″ diameter work

ANOTHER EXAMPLE of Savings with Landis Tool Engineered Grinding Service





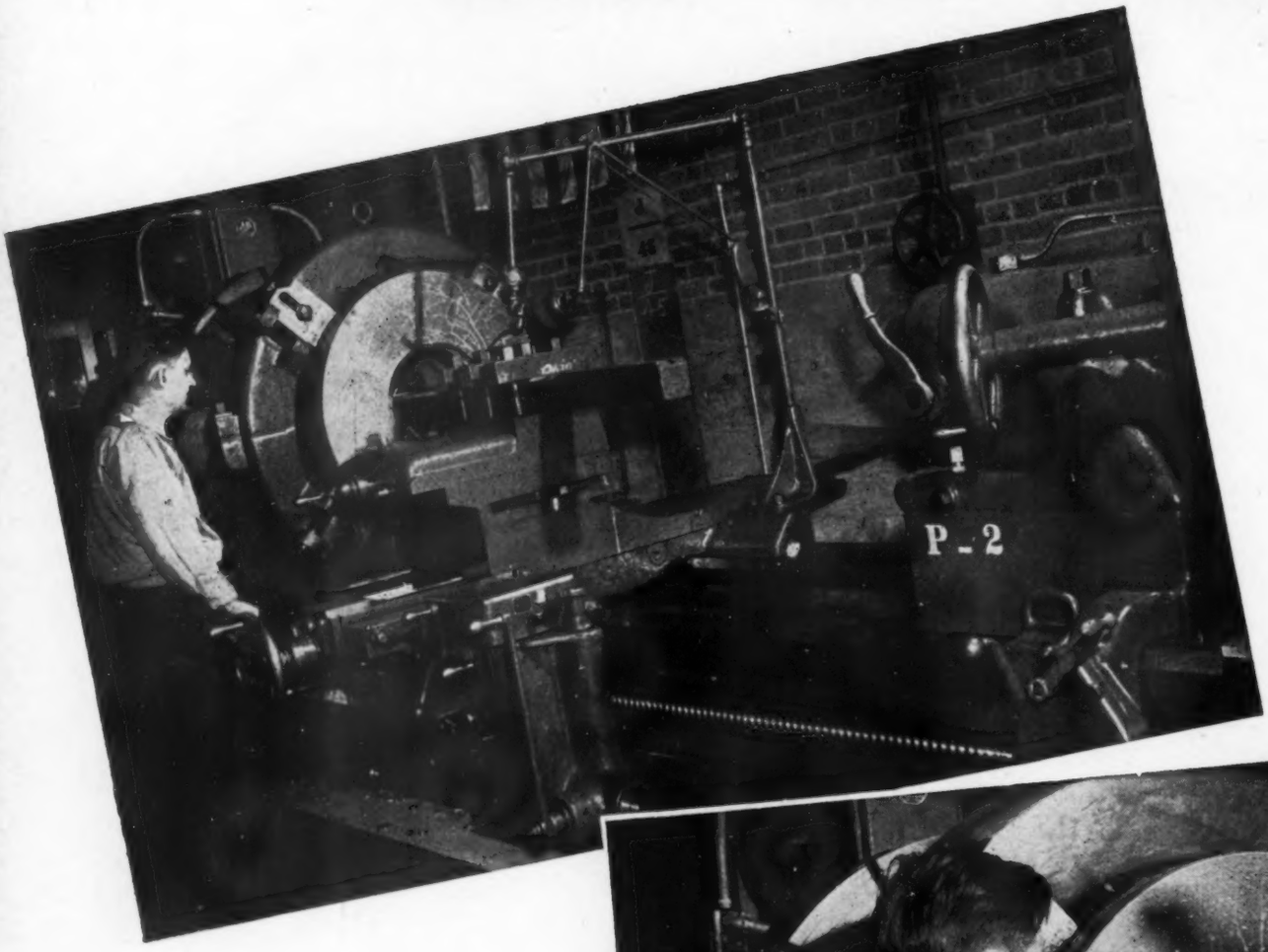
◆ 14″ Type C Hydraulic Universal raised to 30″ swing.

Roller bearing race held on work arbor for grinding outside diameter, 30″ swing. Other sizes ground on this machine shown at right of foot-stock. ▶

LANDIS TOOL Company

WAYNESBORO, PENNA.

Like all True A



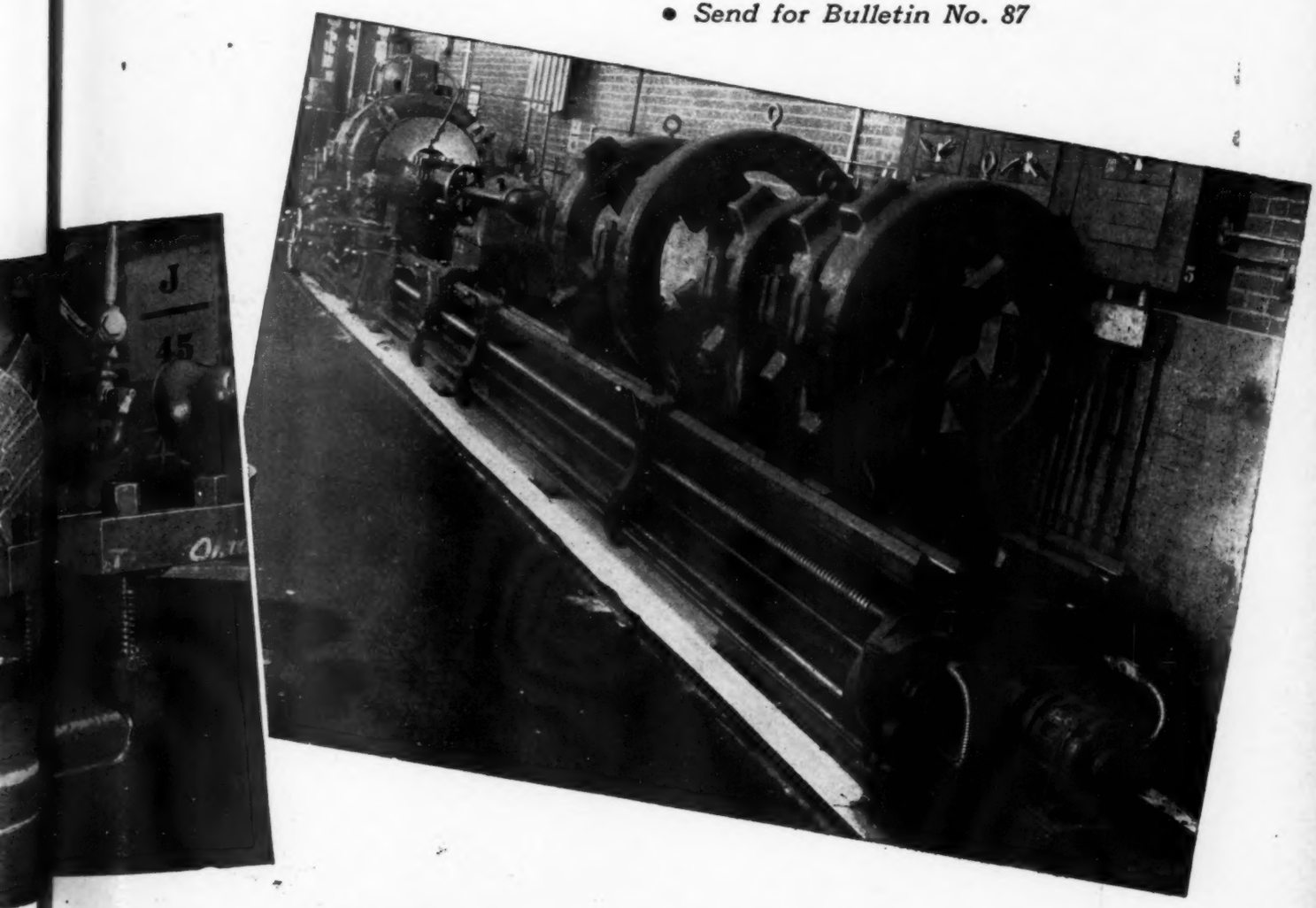
THE AMERICAN TOOL WORKS CO.

AMERICANS...

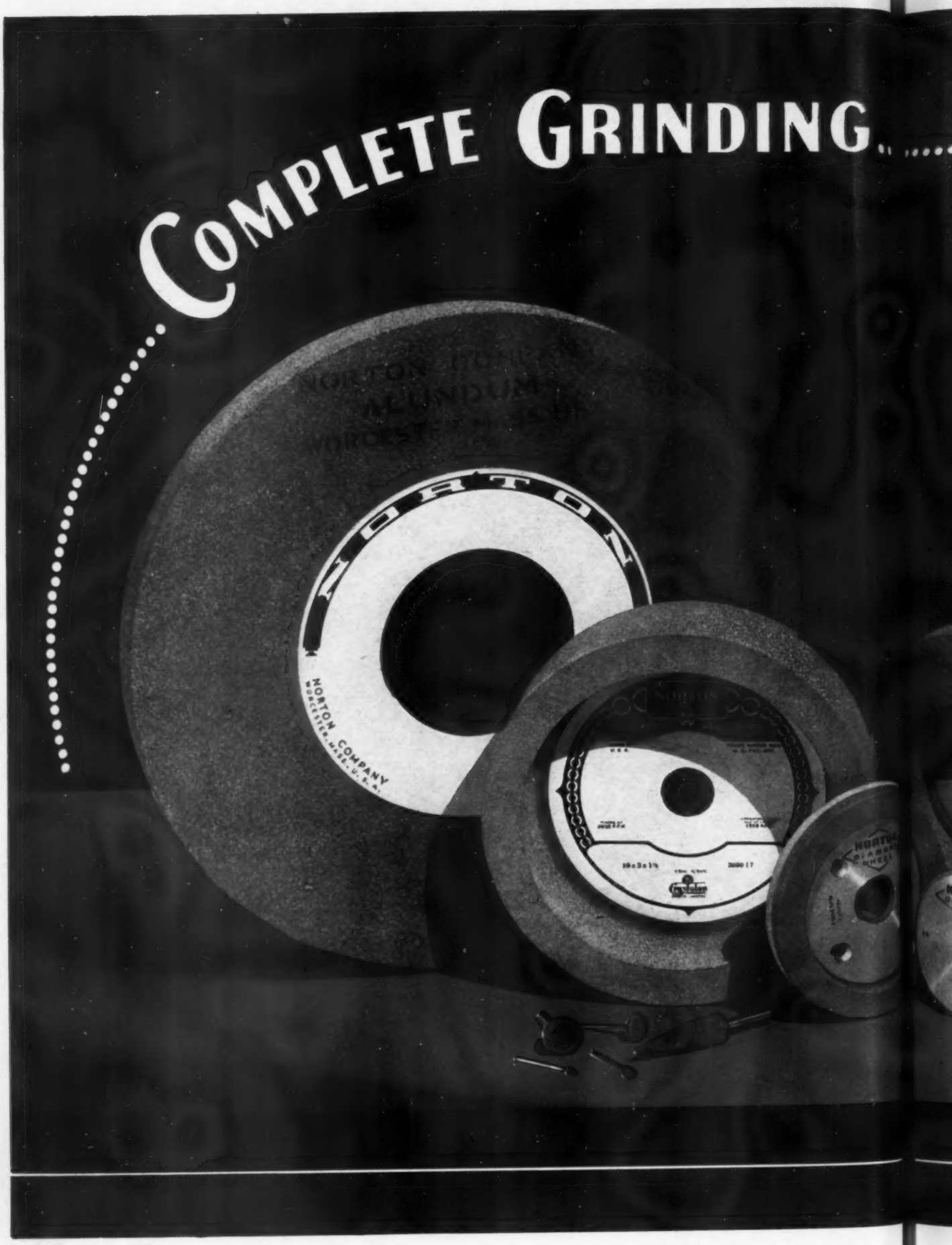
"AMERICAN" Lathes, from the smallest to the largest, are meeting the challenge of production like all true Americans. The power, stamina and endurance built into "American" Lathes have proven invaluable to many a production plant operating on an around-the-clock schedule. Dependable service, minimum shut-down for failures and repairs coupled with an almost unbelievable ability to "keep going" under any and all conditions are genuine "American" characteristics. "American" Lathes are easy to operate, too—another feature that appeals to the operator as do their simplicity of design and complete freedom from complex mechanisms and manipulations.

"American" Lathes are an asset in any plant.

• *Send for Bulletin No. 87*



Lathes and Radial Drills **Cincinnati, Ohio U.S.A.**


COMPLETE GRINDING
NORTON
NORTON COMPANY
WORCESTER, MASS., U. S. A.

G.....WHEEL SERVICE.....

for the Tool Room

The Right Wheel for Each Job
Local Engineering Service
Informative Literature and Films

For High Speed Steel Tools

Alundum, 38 Alundum and 57 Alundum "B-E" bond grinding wheels for sharpening tools and cutters of high speed steels and alloys of the Stellite type.

Open Structure grinding wheels for the jobs that require extra heavy stock removal or extra coolness of cut or both.

Fine grit grinding wheels for producing the high surface finish that greatly lengthens cutting tool life.

For Carbide Tools

Vitrified bonded diamond wheels for the off-hand grinding of single-point cemented carbide tools.

Resinoid bonded diamond wheels for sharpening multi-blade carbide tools such as milling cutters and the like.

Crystolon vitrified wheels (regular and Open Structure) for many roughing operations and for plants doing only a limited amount of carbide grinding.

For Dies and Molds

Mounted Points and Mounted Wheels are available in nearly 200 standard sizes and shapes in several abrasives and bonds.

Norton Open Structure wheels and segments are especially effective for the surfacing of heat-sensitive die steels.

Informative booklets and motion picture films on tool grinding available on request. Write today—no obligation.

Norton Company, Worcester 6, Mass.

Distributors in All Principal Cities

NORTON ABRASIVES

SNYDER SPECIAL CENTER DRIVE MACHINE FOR DOUBLE END TURNING OF SHAFTS

Newest development of a well-proven special-purpose machine design is this center drive, double end turning machine with front and rear tool slides.

Work part shown is an automotive axle shaft on which production is 90 to 100 cycles an hour at 80% efficiency, using tungsten carbide tools throughout. Any similar type shaft can be processed on this type machine with comparable efficiency.

Tailstock center is retractable to permit easy manual loading and is brought in hydraulically by a manually operated hydraulic valve. The part is held between centers without deflection and is gripped by three serrated jaws in the center drive. After loading, the center drive is manually engaged through a clutch lever on the headstock and the part is rotated.

On starting the work cycle, front tools move into position and travel along the work, turning various diameters and forming a taper on one end while the rear tools likewise move in and perform facing, chamfering and undercutting operations.

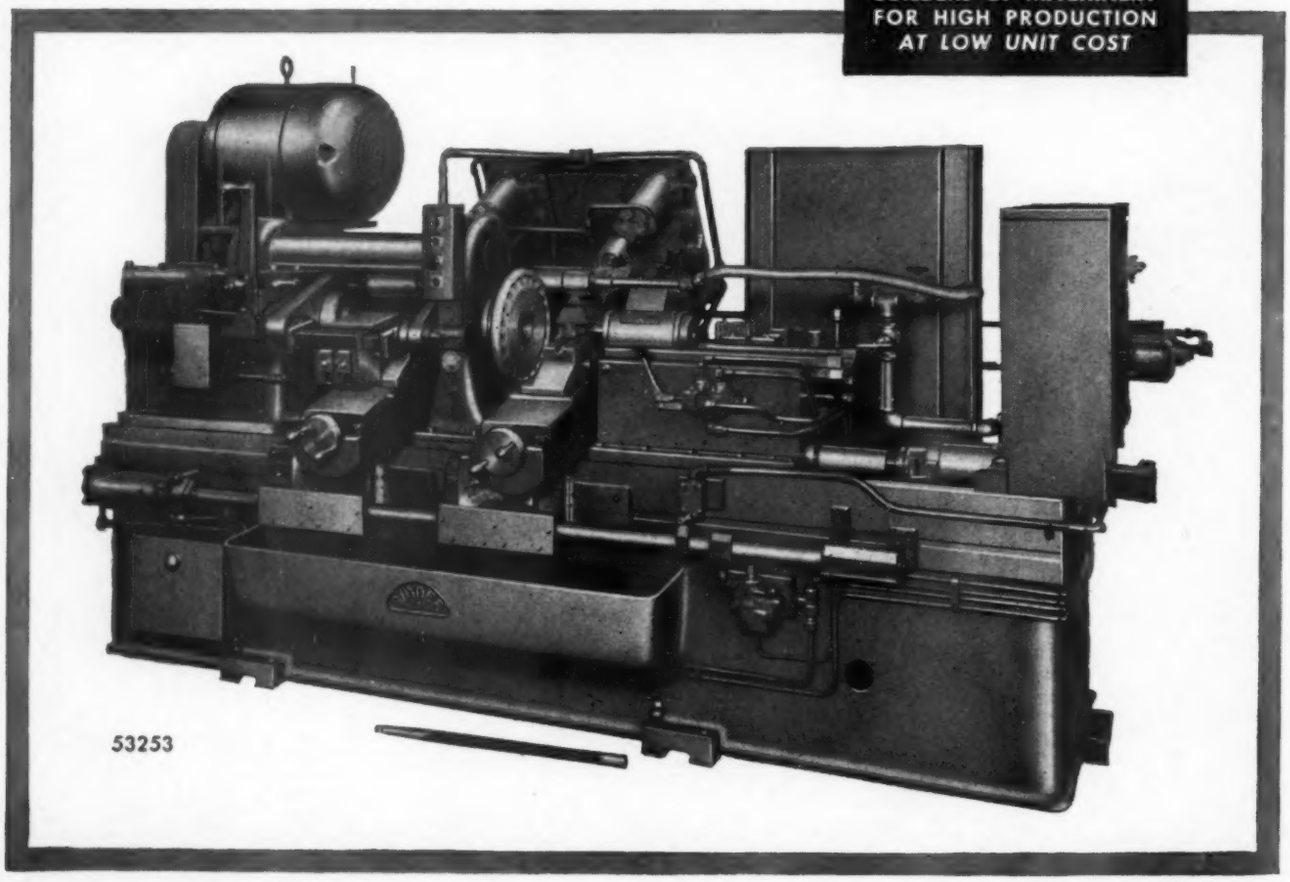
When turning is completed to limits ready for heat treating and finish grinding, tools retract from the work and then return to starting position, thus avoiding spiral tool marks on the work.

Four motors provide operating power, one for headstock and rotation of work, two for hydraulic equipment, one for the coolant pump. Base is welded steel and houses coolant trough and chip pan.

This versatile unit can be adapted to a wide range of related turning applications and offers opportunities for notable economies in production costs. We invite your inquiries. *Snyder Tool & Engineering Company, 3400 E. Lafayette Ave., Detroit 7, Michigan.*

21 Years of Successful Cooperation with Leading American Industries

SNYDER
DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION AT LOW UNIT COST



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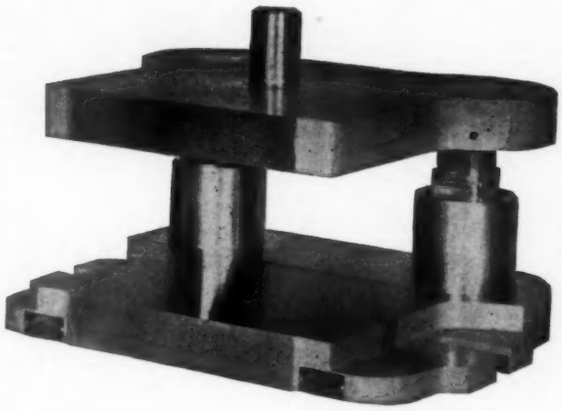


1500 STROKES PER MINUTE WITH THE NEWLY INVENTED

LEMPCO

ANTI-FRICTION DIE SETS

Ordinary die set guide pins froze when used on the new Lempco Punch Press. For its heretofore unheard-of high speeds created too much friction. Years of costly experiments and tests finally perfected these new ball-bearing and roller-bearing type anti-friction guide pins. These revolutionary new die sets may be used in place of ordinary die sets on any machine.

PROMPT DELIVERY!

Brilliantly Conceived . . . Lempco Anti-Friction Die Sets mark a major advance in punch press technique, making possible heretofore unheard-of press speeds. 600 of the most popular sizes are being made. *Write for detailed literature.*

WRITE FOR CATALOG

LEMPCO

5711 DUNHAM ROAD
BEDFORD, OHIO, U.S.A.

BALL BEARING PRINCIPLE . . .

. . . is utilized on the round style guide pin pictured above. Punch holder and die holder are matched, clamped, bored, in same operation, assuring commercially perfect alignment.

ROLLER BEARINGS . . .

. . . are used in square pin style. Guide pins are made of special alloy steel, hardened and ground to very close tolerances. All bearings have original pre-load of .0015".

18,000,000 STROKES . . .

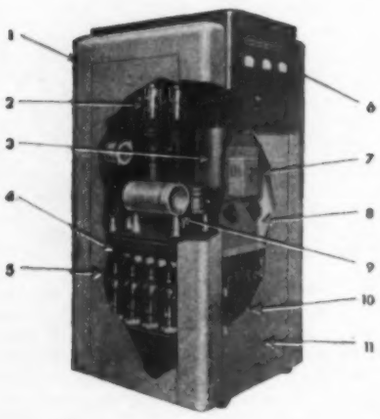
. . . in gruelling experimental runs proved the practical efficiency of patented Lempco anti-friction die sets under even abnormally difficult test conditions.

DIES LAST LONGER . . .

. . . as long as pre-load in bearings last, there can be no "play" between guide post and bushing. This means longer die life and much greater production between die grinds. Reduces die setters' time because dies open and close *freely by hand*, eliminating need for jacks or pry bars.

It's Easier

1 INDUCTION HARDENING is actually so simple, that totally inexperienced help, using a work coil of proper design, can handle really "tough" hardening jobs. Reason is you can apply heat to a *pre-selected* area of a part, leaving the balance completely unaffected. Simply place part in work coil and press start button to apply heat.



THESE FEATURES MEAN BETTER, LOWER COST PRODUCTION FOR YOU!

1 What's your heating problem? Brazing? Hardening? Soldering? Annealing? Melting? Heating for Forging? This new productive unit handles them all!

2 Sturdy, long-life Oscillator Tubes are fully protected against overloads.

3 New Coupling System developed by A-C keeps losses low and improves the output efficiency

4 Complete 3-Phase Power System with over 90% power factor.

5 Transformer is designed for heavy-duty 'round the clock production. Has large reserve capacity.

6 Large, easily read instruments show when power is on, also indicate grid and plate currents including filament voltage.

7 Automatic Timer controls heat sequence in split seconds from 2 seconds to 20 minutes . . . makes unit easy for unskilled operators to use. Also gives high product uniformity and reduces rejects.

8 All controls are on one panel . . . protected from tampering by door and lock.

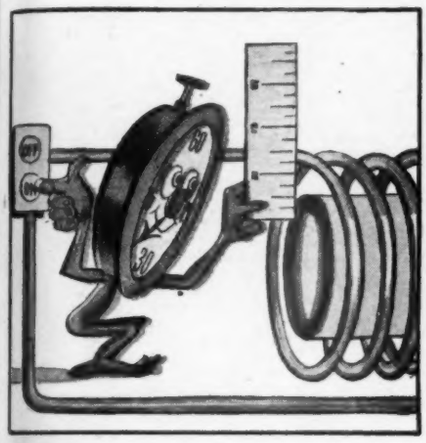
9 Specially designed Choke Coil protects rectifier tubes from damage by high frequency radio currents.

10 Safety Features: Heavy-duty control; high water-temperature switch; fuses; interlocking switches on doors protect operators.

11 Attractive, Compact Steel Cabinet mounted on heavy-duty casters encloses unit. Provides shielding.

to Harden...

WITH ALLIS-CHALMERS GREAT NEW INDUCTION HEATER



2 AUTOMATIC TIMER can be set for any heat sequence in split seconds from 2 seconds to 20 minutes. When the *exact amount* of heat has been applied at *exactly* the right *intensity*, timer turns off power. Each successive part receives the same amount of heat, resulting in a uniformity difficult to obtain with other heating methods.

3 CONTROLLED QUENCHING is secret of uniform hardening! With Allis-Chalmers Induction Heater, water quench can be *direct connected* to Timer. Quenching operation and heat sequence are *identical* each time. This feature, plus design of work coil, completely controls hardness and depth of penetration within very close limits.

4 HARDENING SEVERAL pieces at the same time, coupled with simple, automatic handling equipment further increases production. A-C's Induction Heater is now being successfully used for lower cost hardening of a wide variety of items in many industries. Why not cut your production costs with this new electronic tool?

NEW MOVIE EXPLAINS INDUCTION HEATING

This new A-C movie in full color and sound shows how a typical 5 minute hardening operation is completed in less than 5 seconds . . . other spectacular brazing operations! Contact your nearest A-C District Office for a showing, or write direct to Allis-Chalmers, Milwaukee 1, Wis. for a copy on loan. Film runs 12½ minutes on 16mm sound projectors only.

A 1997

ALLIS A-C CHALMERS

MILWAUKEE 1, WISCONSIN

Pioneer Builders of Electronic Equipment for Industry.

HEAR THE BOSTON SYMPHONY: *Saturday, American Broadcasting* **Co.**

WHICH SIDE OF THIS LINE

Are You On?

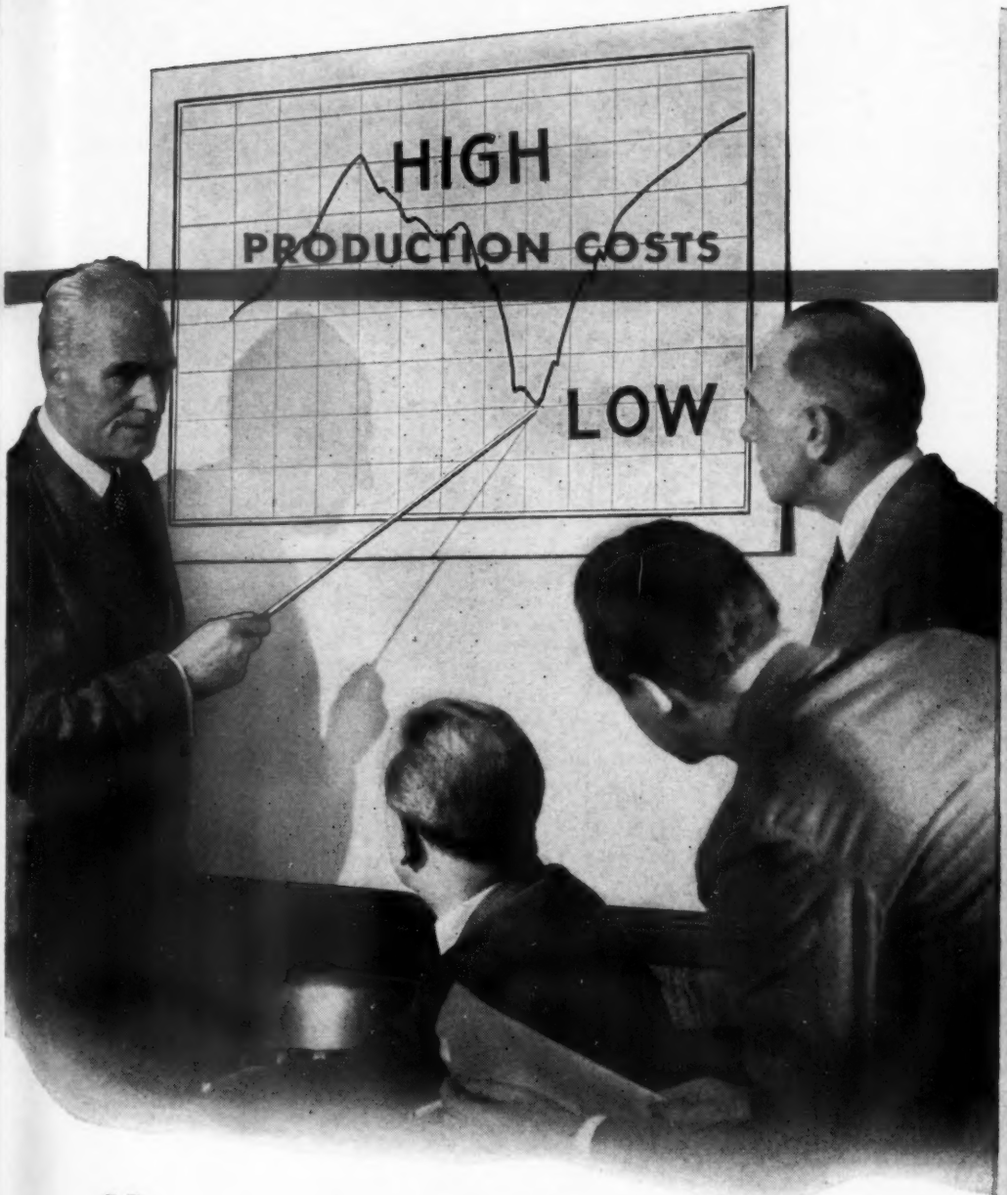
EX-CELL-O's Complete Parts Production Facilities Can Help You Lower Unit Costs

XLO

EX-CELL-O *for* PRECISION

Shown are two typical views of Ex-Cell-O's parts manufacturing facilities. *Left:* Multiple spindle automatic screw machines roughing miscellaneous parts from tubing and bar stock. *Above:* One of the many production lines where sequence of operations is efficiently engineered for low cost production.

EX-CELL-O CORPORATION



Not all manufacturers know that Ex-Cell-O can offer the highest quality production of parts and assemblies at a remarkably low cost per unit. This is because of Ex-Cell-O's unique combination of engineering experience, skilled manpower, and the most modern facilities, including machining, heat-treating, grinding, sub-assembling, and inspection—all under one management. Send your print or part to Ex-Cell-O at Detroit today, or contact one of Ex-Cell-O's field engineers in leading industrial centers throughout United States and Canada.

DETROIT 6, MICH.

EX-CELL-O's Precision Production Parts *facilities:*

PRODUCTION ENGINEERING

The Ex-Cell-O organization, with skill, facilities and modern methods that have made a wartime record, can make an important contribution in the planning of quantity production of quality parts and unit assemblies for your postwar product.

PRODUCTION MACHINES

Multiple Vertical Turret Lathes
Multiple Spindle Automatic Screw Machines
Single Spindle Automatic Screw Machines
Hand Screw Machines
Engine Lathes
Centerless O.D. Grinders
Centerless I.D. Grinders
Single and Multiple Spindle Drilling Equipment
Form Grinding Machines
Plain O.D. Grinders
Plain I.D. Grinders
Surface Grinders (Plain and Rotary)
Milling Machines
Thread Milling Machines
Broaching Machines (Vertical and Horizontal)
Precision Thread Grinders
Thread Rolling Machines
Precision Boring Machines
Lapping Machines
Special High Production Equipment

HEAT TREAT

Induction Heat Treating
Laboratory for Heat Treat Control including Micro Examination and Photography
Atmosphere Control Continuous Hardening Furnaces
Atmosphere Control Box Hardening Furnaces
Various Types of Air-Draw Batch Type Furnaces
Gas Carburize Furnaces
Box Carburize Furnaces
Pack Anneal Furnaces
Nitriding Furnaces
Cyanide, Lead, and Neutral Salt Pot Furnaces
High Speed Steel Atmosphere Control
Vertical and Horizontal Hardening Furnaces
Continuous Air-Draw Furnaces
Sub-Zero Heat Treating Equipment

UNIT ASSEMBLIES

For many years Ex-Cell-O has supplied large and small manufacturers with parts and has also supplied many parts in unit assemblies after machining, heat treating and grinding.

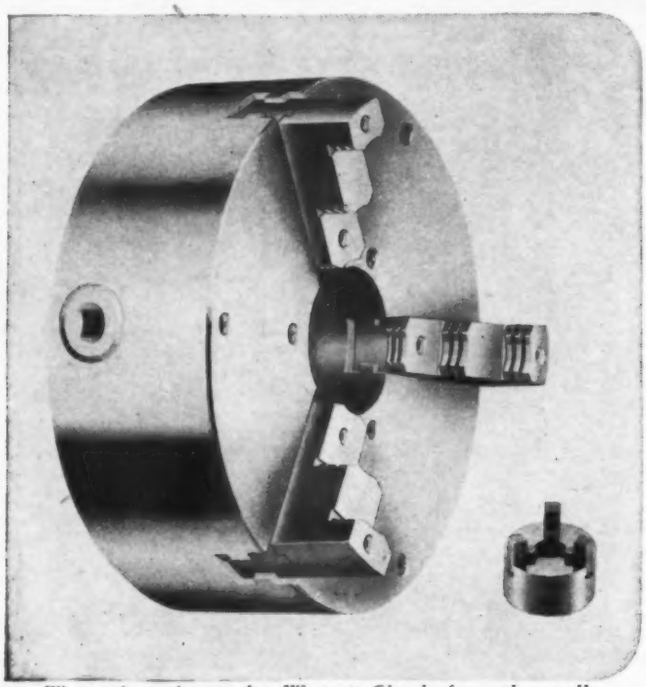
INSPECTION

Ex-Cell-O has always maintained that quality in a product is not the result of accident; that quality is built into a product by rigid adherence to accepted quality standards . . . standards that are upheld at Ex-Cell-O by efficient inspection at every step of the machining process.

Where increased production, high accuracy, and greater economy through multiple operations are required . . . See Ex-Cell-O First!

40—42

One New WARNER & SWASEY



The variety of parts for Westcott Chucks from the small 2" up to the 12" diameter chuck are machined on a single 2-A Warner & Swasey Turret Lathe.

The Westcott Chuck Company, Oneida, New York, makes fine chucks—machining work that calls for high precision.

It makes them in a wide range of sizes.

Chuck parts were being produced on four old style turret lathes—not too economically because these old models could not hold extreme accuracy. They were used only for roughing cuts, and separate finishing operations were required.

A new Warner & Swasey 2A Turret Lathe was purchased. It was found that this *one* new machine could handle *both* rough and finish operations and outproduce the *four* old turret lathes. Its wide range of capacity enabled it to be used readily on many sizes of chuck parts.

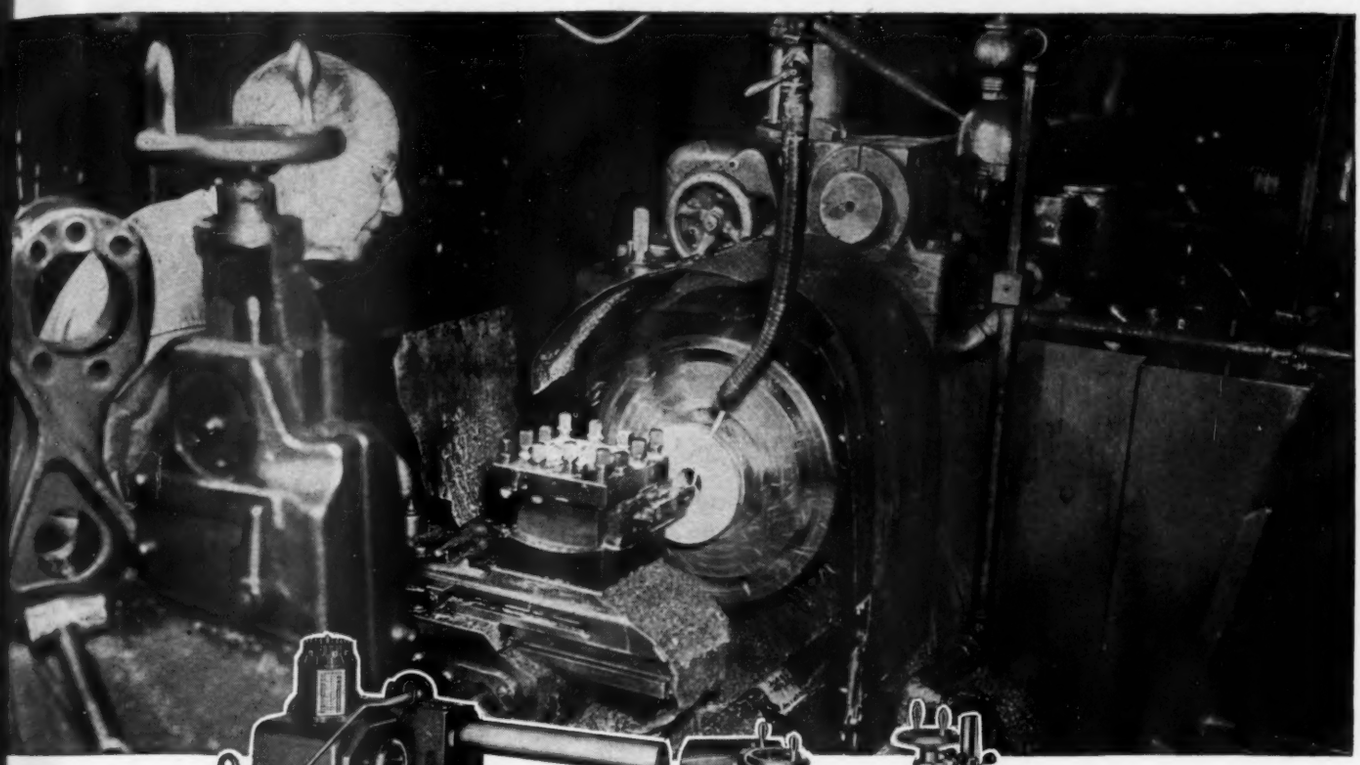
The experience of the Westcott Company can be paralleled in hundreds of plants . . .

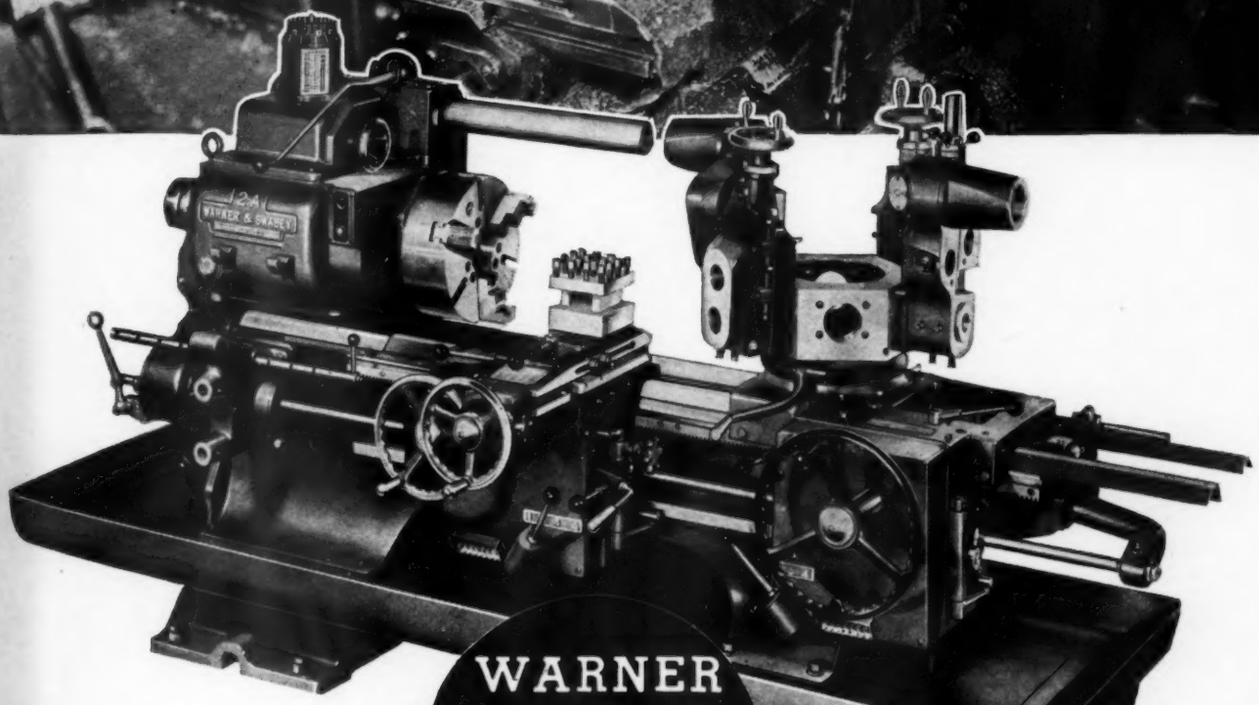
Why not avail yourself of the experience and specialized knowledge of a Warner & Swasey field representative?

- **New Warner & Swaseys incorporate a number of improvements that may be extremely profitable on your particular work.**
- **Accessory equipment also can be installed on many older model Warner & Swaseys to increase productivity.**
- **A new Warner & Swasey Multiple Spindle Automatic now makes short runs practical and profitable.**
- **Warner & Swasey Precision Tapping and Threading Machines bring radically new principles that result in remarkable increases in production.**

TURRET LATHES, MULTIPLE SPINDLE AUTOMATICS, PRECISION TAPPING & THREADING MACHINES

EY does the work of four old machines





Call the nearest Warner & Swasey branch office or write—Warner & Swasey, Cleveland, Ohio

WARNER
&
SWASEY
Machine Tools
Cleveland

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS . . . WITH A WARNER & SWASEY

FIRST NEWS about

This is the first information on two new sander discs by CARBORUNDUM. They have such improved performance that we want to get the news to you as soon as possible. A listing of advantages would include:

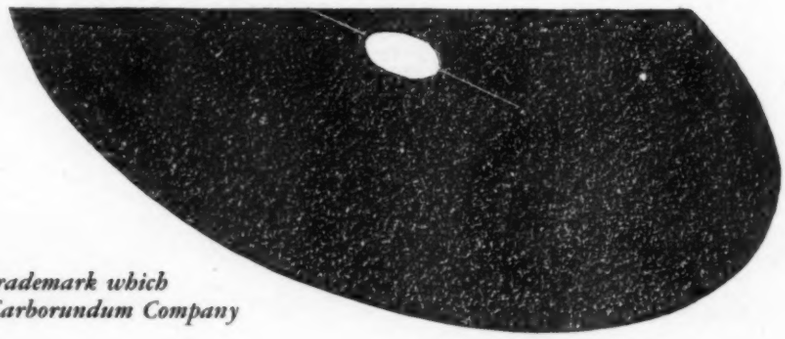
1. **Substantially longer life.**
2. **Faster cutting.**
3. **Heat resistant.**
4. **Broad application in metal surfacing.**

The obvious benefit, of course, will prove to be more production at lower abrasive cost.

Certainly the Glue-Resin Sander Disc by CARBORUNDUM, with brown backing, will be found to give broad usage and unusual service in all metal surfacing operations. It is available in the following six grit sizes: 16, 24, 36, 50, 60, 80.

The Resin Sander Disc, with green backing, and same grit selection as the Glue-Resin

For sanding and finishing satisfaction . . . **CALL**



"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

a BIG improvement in Sander Discs

Disc by CARBORUNDUM is specially recommended for severe sanding operations and the edge-wear grinding jobs which take such a heavy toll of ordinary discs.

The backing of both discs are marked for ready identification, usage and reordering.

These discs by CARBORUNDUM are standard in 7″ and 9⅛″ dia. The Glue-Resin Sander Discs are available in Type D-1 (center hole with slits) while the Resin Sander Discs are available in Type D-2 (center hole only). Prompt deliveries will be made from standard stocks in plant and branch warehouses.

We think you will want to learn all the facts about these discs without delay. Call your CARBORUNDUM salesman or distributor's representative for complete information. The Carborundum Company, Niagara Falls, New York.

IN CARBORUNDUM

TRADE | MARK

BONDED ABRASIVES

WHEELS
- Silicon Carbide
- Aluminum Oxide
- Diamond

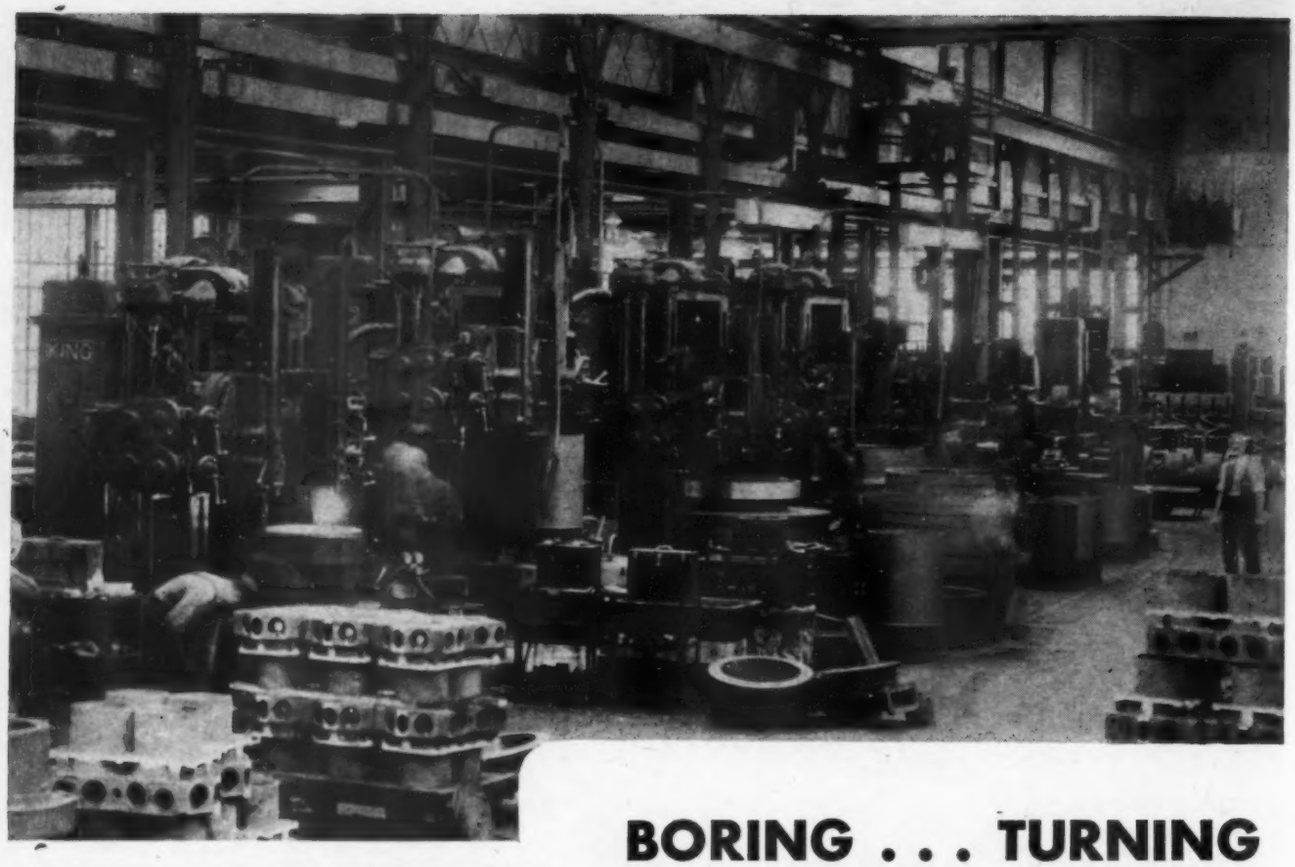
Cylinder Hones
Sticks, Stones & Rubs
Specialties

COATED ABRASIVES

Paper, Cloth and Combination
Sheets, Rolls, Discs

ABRASIVE GRAINS AND COMPOUNDS

for:
Polishing
Lapping
Pressure Blasting
Finishing



POWER SPEED ACCURACY

★

KING BUILDS

Vertical Boring and Turning Machines exclusively — single column types from 30" to 42" double column types from 52" to 12 feet.

★

BORING . . . TURNING AND FACING

The KING *Way*

● This display of King Vertical Boring and Turning Machines gives definite evidence of the wide variety of boring and turning jobs that can be handled easily —quickly—economically on these machines.

The machines shown represent but a portion of a large battery of King Boring and Turning machines in the plant of a prominent pump manufacturer.

King Boring and Turning machines have the stamina to produce 24 hours a day—speed and feed range to meet varying operating conditions—rigidity to maintain precision tolerances over long periods.

For speed—accuracy—high production—and versatility put your precision — boring — turning — facing operations on a King Vertical Boring and Turning Machine.

THE KING MACHINE TOOL COMPANY
CINCINNATI 32, OHIO

BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY

Continental COUNTERBORE SETS

A Size For Every Purpose

The indestructible drive and rigid, yet simple, construction of the Continental Interchangeable Counterbore assures long and dependable service. The holder and cutter are disengaged by a twist of the wrist; no tools or equipment are needed, no matter how severe the operation has been.

Continental Interchangeable Counterbores are now available in a choice of three sets, each providing a wide variety of useful, dependable tools. In complete yet compact form, you will find a selection designed to fill the needs of the large or small toolroom. Set No. 1 (illustrated), for the small shop, includes cutters up to 1 1/16" diameter, with two holders. Set No. 2, also with two holders, has cutters up to 1 1/2" diameter. Set No. 3 provides cutters up to 2" diameter and has four holders. Whichever you choose, you will be sure to get fine, precision-made cutting tools.

CONTINENTAL TOOL WORKS

Division of Ex-Cell-O Corporation

DETROIT 6, MICHIGAN

CONTINENTAL TOOL WORKS
CTW
EX-CELL-O CORPORATION

Continental

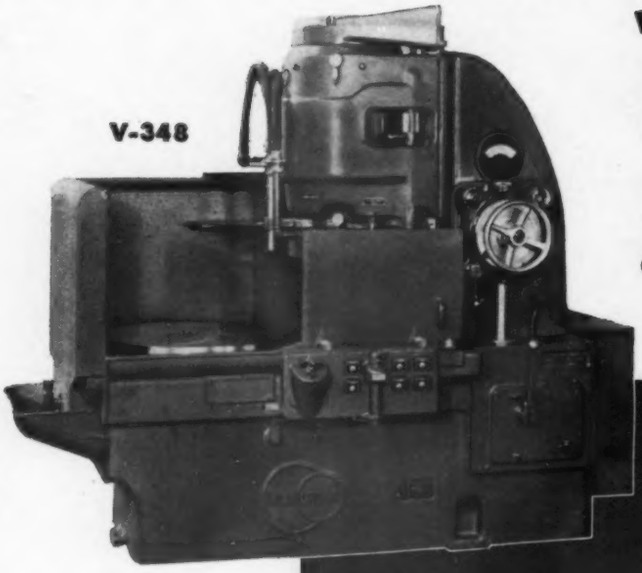
CUTTING TOOLS

- Boring Bars and Tools
- Broaches Broach Pullers Broaching Fixtures
- Core Drills
- Counterbores and Countersinks
- CTW Drive Holders
- Counterbores (Tool Room Sets)
- Counterbore Pilots
- Inserted Blade Cutters
- Carbide Tipped Cutters
- Form Relieved Cutters
- Milling Cutters
- Thread Milling Cutters
- End Mills
- Side Mills
- High Speed Steel Reamers
- Carbide Tipped Reamers
- Shell Reamers
- Inverted Spotfacers
- High Speed Steel Tool Bits
- Carbide Tipped Tool Bits
- Circular Form Tools
- Cut-off Tools
- Flat Form Tools
- Dovetail Form Tools

42—43

"Put it on the Blanchard"

from *start* to *finish*



Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

5" Dia. Valve Plates *finish-ground on both sides from the rough castings—in one operation per side.*

PRODUCTION: 33 pieces (66 surfaces) per hour.

Here's a typical example of the constantly increasing use of the Blanchard for machining flat surfaces on castings and forgings directly *from the rough* to finish—*in one operation.*

The 5" dia., ½" thick, cast-iron, pump-valve plates are held on the standard 36-inch magnetic chuck of a No. 18 Blanchard Surface Grinder. *Stock removal is 3/32" from each side.* The Blanchard easily meets the requirements of size tolerance of ± .001" and parallelism within .001"—*with a fine finish* so that no lapping operation is necessary to make tight joints.

"Putting it on the Blanchard" eliminates facing and lapping of each of the 66 surfaces. Production is more than tripled.

Blanchard engineers—with their more than thirty years' experience in grinding flat surfaces—welcome the opportunity of showing you how to grind it better . . . faster . . . more profitably.

Get These Advantages

- **Production ✓**
- **Adaptability ✓**
- **Fixture Saving**
- **Operation Saving**
- **Material Saving**
- **Close Limits**
- **Fine Finish ✓**
- **Flatness ✓**

BLANCHARD

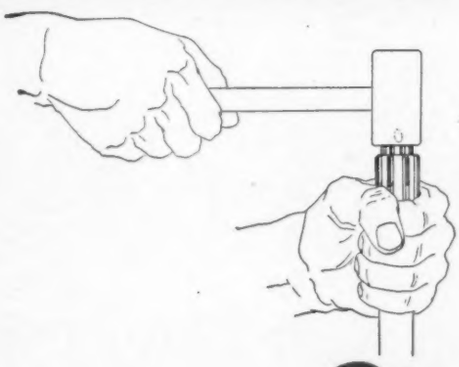
The **BLANCHARD** MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

Staples exclusive Expansion Reamers offer an *extra* plus that improves your quality and cuts operation time. It's diamond lapping . . . for the finer finish that means closer tolerances . . . quicker.

Closer TOLERANCES

AGAIN and AGAIN and AGAIN . . . WITHOUT REGRINDING



TO EXPAND . . .
JUST DRIVE IN
THE TAPERED PLUG

Use these better tools — the only ones with Carboloy tips that expand again and again and again without regrinding. Use them — to reduce your tool costs, obtain longer tool life and better hole finish.

THE STAPLES TOOL COMPANY
Formerly Staples Tool & Engineering Company
CINCINNATI 25, OHIO

Staples CARBOLOY-TIPPED CIRCULAR CUTTING TOOLS

REAMERS • CORE DRILLS • SPOT FACERS • COUNTERBORES • END MILLS • SHELL END MILLS • ALSO A COMPLETE LINE OF CIRCULAR SPECIAL TOOLS

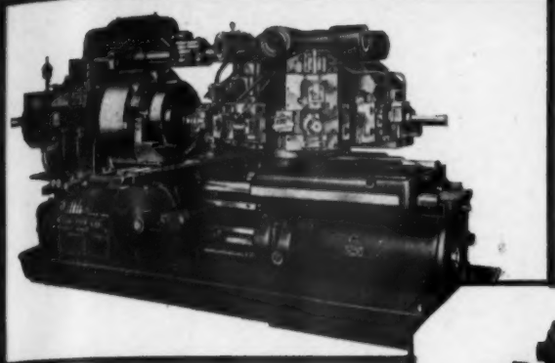
THE TUBE REMAINS STATIONARY...

IT'S THE CUTTER HEAD THAT ROTATES

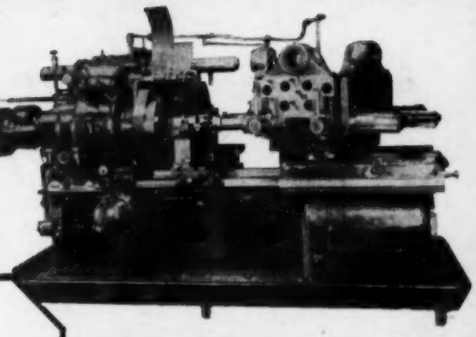
ETNA

Tube Cutoff Machine

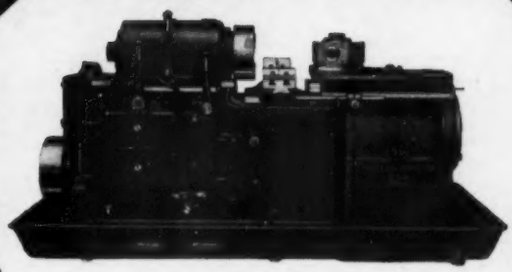
THE ETNA MACHINE CO., TOLEDO 10, OHIO

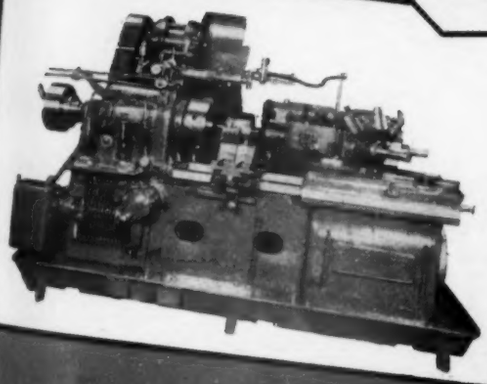


P&J 8DT and 8DXT Automatics
Bulletin 112



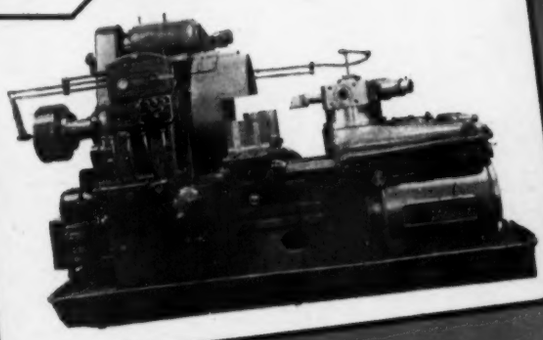
P&J 5D Two Spindle Power-Flex
Automatic. Bulletin 120





P&J 5D Power-Flex Automatic
Bulletin on request

P&J 4D Automatic
Bulletin 112



P&J 6DREL and 6DRELX
Automatics. Bulletin 118

AUTOMATIC CHUCKING *and* TURNING MACHINES

There are no practical limits to the variety of work these machines will handle

These five models in the P&J line are designed to meet all needs of metal working shops for high production of duplicate parts at low cost for power, labor and maintenance. The capacity range covered by these machines is inclusive, parts small or large being handled with equal facility and at closely and easily held tolerances. Tooling to meet specific requirements is an inherent, advantageous feature of every machine in the P&J line.

Send for illustrated, descriptive literature

BUY SAVINGS BONDS TODAY FOR SECURITY TOMORROW

POTTER & JOHNSTON MACHINE CO.
Pawtucket, R. I.

Bridgeport

TURRET MILLING MACHINE

Specifications

Longitudinal Feed	20"
Cross Feed	9"
Vertical Feed of Knee	16"
Standard Table	9 x 32"
Special Tables up to 48" available; also longitudinal power feed.	
Weight with Shaping Unit	2000#

The

Bridgeport

MACHINES, Inc.
BRIDGEPORT, CONN.

While we have not made any such investigation ourselves, we doubt that you will find Bridgeport Turret Milling Machines on many "surplus" lists. Owners just don't part with them because they are machines of many uses. Ability to mill, drill, bore and shape at all angles of the work gives the "Bridgeport" a versatility which makes it an invaluable machine for production or tool room requirements. High volume at low cost, with maintained accuracy in long, hard service are other reasons why "Bridgeports" just don't become obsolete.

It is reported that . . . . . .

Silicone oils, suitable for use in aircraft hydraulic systems, that will flow at 120 degrees below zero and do not oxidize at 302 above, have been developed in the General Electric Laboratories.

get ready with CONE for tomorrow

Relatively weak, soft strands of cotton fibre (roving) are impregnated with resin by a new process developed by Walter Kidde & Co. The yarn resulting is said to be stronger than one of the same size made in the conventional manner.

get ready with CONE for tomorrow

Spark plugs with electrodes that grow with use instead of wearing away are a recent contribution of the electrical engineering department of Yale University.

get ready with CONE for tomorrow

Alcoa's Cleveland Works test aluminum castings to destruction by centrifugal force in an armored pit. Parts are turned up to 25,000 r.p.m. in a partial vacuum.

get ready with CONE for tomorrow

The National Bureau of Standards sees the end of the octane system of evaluating motor fuel and suggests a leaded triptane-neptane scale to be known as a "detonation index".

get ready with CONE for tomorrow

Baldwin Locomotive Works have completed a locomotive for the Seaboard Railway that uses two 1,500-horsepower diesel engines with electric drive in a single unit instead of the usual two or more coupled units.

get ready with CONE for tomorrow

By comparing the magnetism produced in a sample with standard specimens of known hardness, the new magnetic hardness tester made by General Electric tests parts too small for mechanical hardness gages.

Nitric oxide can now be made by an efficient, simple and inexpensive method developed in the chemical laboratories of the University of Wisconsin.

get ready with CONE for tomorrow

Said to be the hardest in the world are the new vitrified bonded diamond wheels made by Norton Company.

get ready with CONE for tomorrow

A new kind of small, powerful magnet is made by General Electric of iron and cobalt oxides and is not itself a conductor of electricity.

get ready with CONE for tomorrow

Ford's new foundry method is to bring the molds to the molten metal.

Pyrene is equipping diesel-electric locomotives with carbon dioxide extinguishers that will detect and put out fires inside or underneath them.

get ready with CONE for tomorrow

Jack and Heintz state that their new Skinner gasoline engine will be the first die-cast engine ever produced.

get ready with CONE for tomorrow

The new small tractor that Allis-Chalmers is expected to introduce will push its tools instead of pulling them. Price is expected to be under $400.

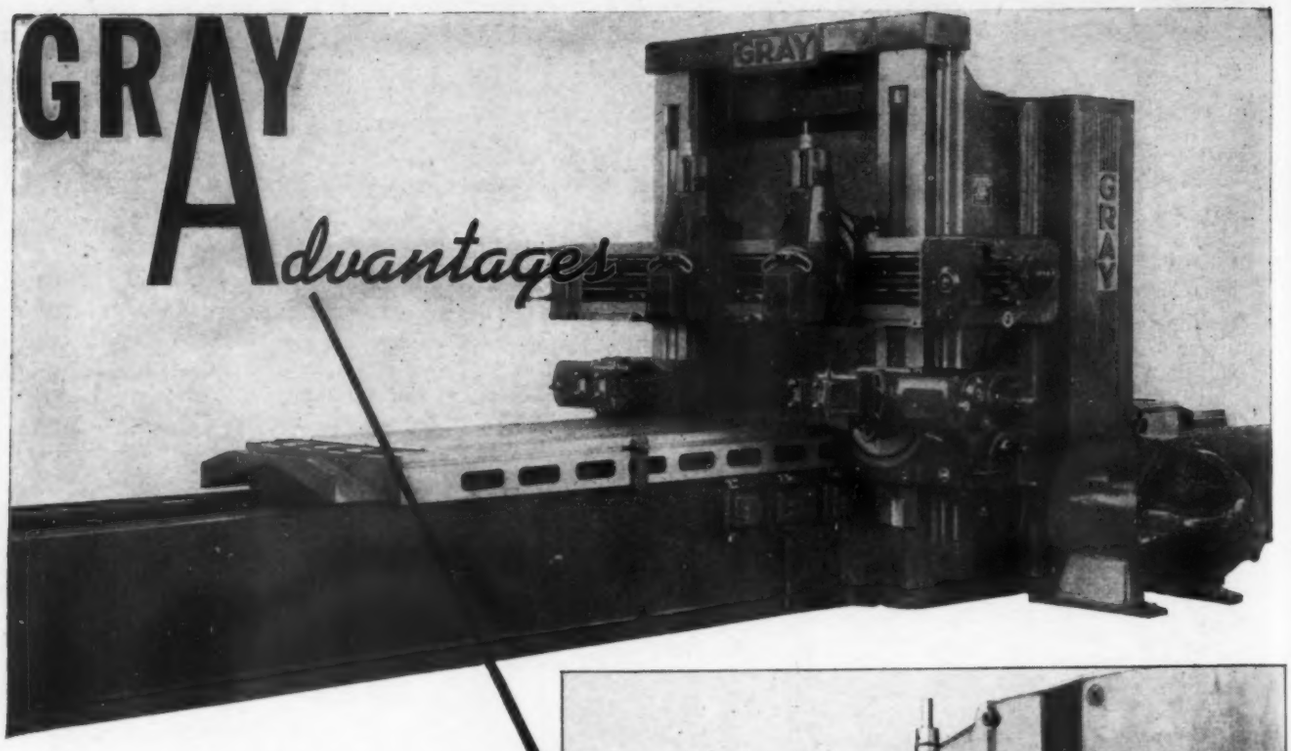
get ready with CONE for tomorrow

American Gas & Electric Service Corp. announces plans to set up a 500,000-volt transmission line in Ohio to experiment with the sending of ultra-high voltages.

get ready with CONE for tomorrow

Two-way conversation between moving trains is undergoing a three months' test at the Wayne Junction Yard of the Reading Railroad.

GRAY Advantages



PRECISION TOOL POINT LOCATOR

As the name implies, it enables the operator to set the tool with the utmost precision right at the head itself instead of from the end of the rail. This is a tremendous advantage, particularly on large machines.

The Gray Precision Tool Point Locator together with the Gray Tool Point Control, enables the operator to rapid traverse either or both heads, engage the feed in either direction and set the saddles and slides at the head itself as well as from both ends of the cross rail.

Write for Bulletin No. 40-R-3 illustrating and describing the many other Gray advantages that increase production or improve the quality of the work.

DOUBLE HOUSING and OPENSIDE PLANERS
•
SWITCH PLANERS
•
DIE BLOCK PLANERS
•
MILLING PLANERS
•
PLANER TYPE MILLING MACHINES
•
HORIZONTAL BORING MACHINES

The G.A. GRAY Co.

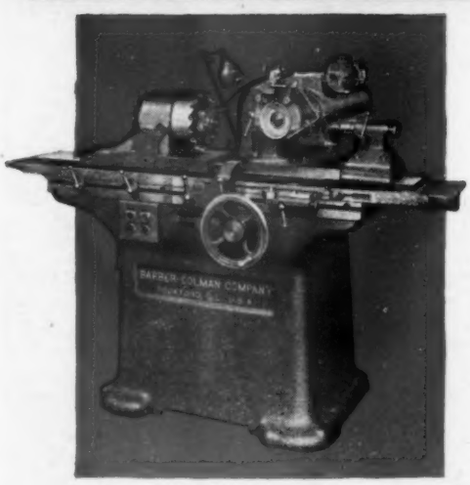
CINCINNATI 7, OHIO, U. S. A.

Sold in Canada by Upton, Bradeen and James Ltd. ● Sold in Latin America by Machine Affiliates.

BARBER-COLMAN

HOBS • HOBBING MACHINES • HOB SHARPENING MACHINES • MILLING CUTTERS
REAMERS • REAMER SHARPENING MACHINES • SPECIAL TOOLS

COMBINATION SHARPENING MACHINE
DEMONSTRATES BUILT-IN ACCURACY
FOR SHARPENING HOBS • CUTTERS • REAMERS



A VERSATILE MACHINE

A large planer manufacturer has used this Barber-Colman Combination Sharpening Machine for four years, reconditioning all hobs, cutters, reamers and other straight and helical work. As many as 10 to 15 hobs per day ranging from 2 DP to 10 DP have been resharpened. The following statement quoted from a recent field report shows the quality control obtained from the Combination Machine.

"There has been no definite down time on this machine, and the replacements made were on parts that received the usual amount of wear. Although we field men encourage the checking of hob sharpening, this concern has not had to do any hob checking due to reliance they have in the machine." Why not investigate the Barber-Colman Combination Sharpening Machine for closer accuracy control and corresponding longer tool life as a means of reducing tooling costs.

Write for Bulletin F-1486

BARBER-COLMAN COMPANY

HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

GENERAL OFFICES AND PLANT • 111 LOOMIS STREET • ROCKFORD, ILLINOIS, U.S.A.

Capacity . . .

With this battery of twelve No. 6A and No. 9A MARVEL High Speed Automatic Hack Saws, the Hammond & Irving Forge Co. of Albany, New York can cut-off billets automatically, not only in tremendous numbers, but in accurate weights and sizes to exactly fill each die without waste. With 12 of the "world's fastest cutting-off saws", they were able to keep all hammers running on their tremendous war orders, and were able to instantly resume peacetime manufacturing without re-tooling or other delay. The No. 6A and No. 9A MARVEL automatics have capacities of 6" x 6" and 10" x 10" respectively.

In addition to the battery of MARVEL Automatics, Hammond & Irving have cutting-off *capacity* of a different sort in their MARVEL No. 18 Hydraulic Hack Saw—capacity for size because this roll stroke giant cuts off billets and bars in 18" x 18". It easily handles the toughest and hardest steels.

MARVEL 18
for Size,
MARVEL 6A and 9A
for Volume Production

ARMSTRONG-BLUM MFG. CO.
"The Hack Saw People"
5700 BLOOMINGDALE AVENUE CHICAGO 39, U. S. A.
Eastern Sales Office: 225 Lafayette St., New York 12, N. Y.

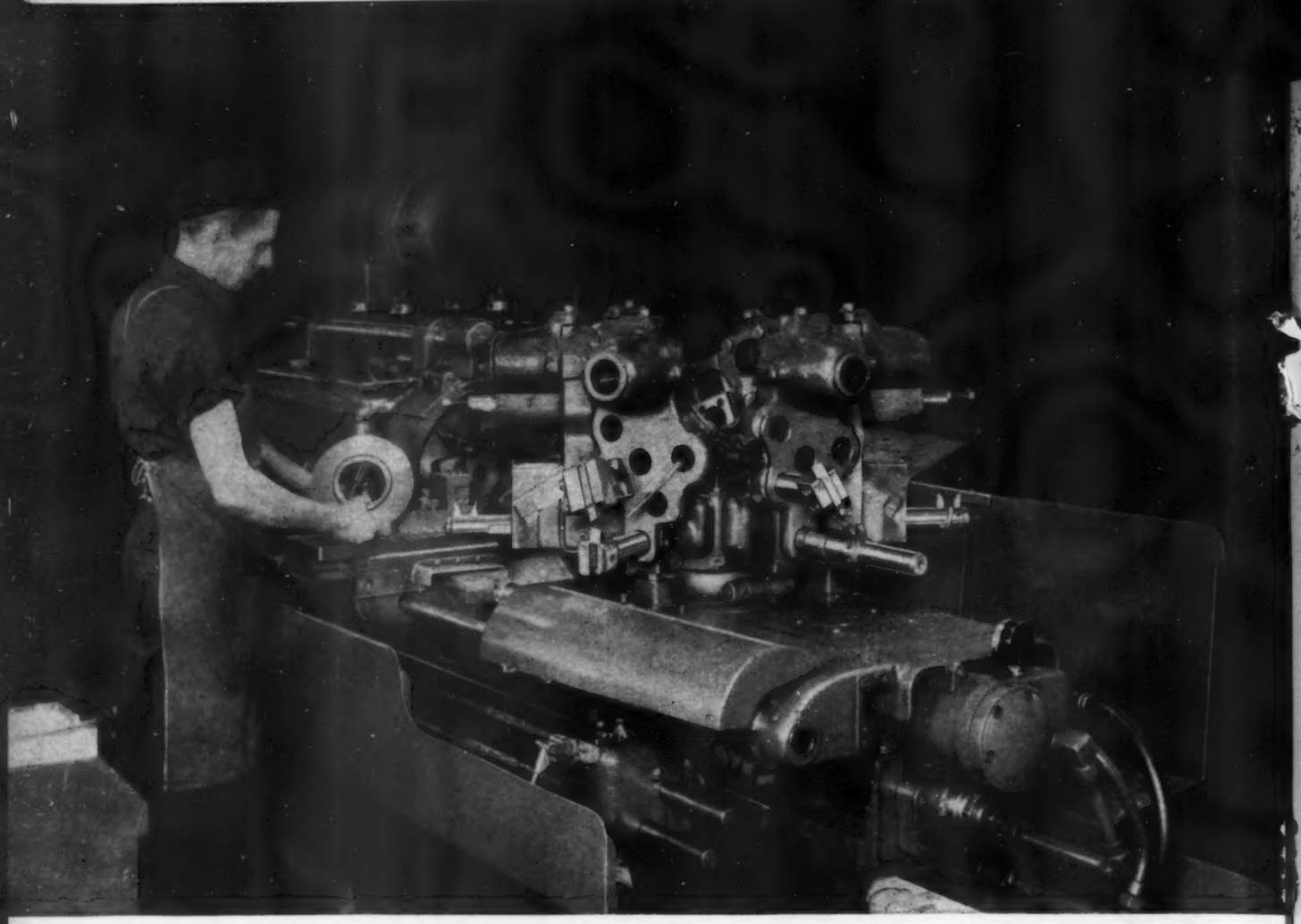
SIMONDS Red Tang FILES

...they keep your File-Costs down

RED TANG FILES have the same basic tooth-design as Simonds Metal-Cutting Saws. So Red Tangs *cut,* instead of *scrape* . . . remove more metal with less elbow-grease. That's why workers like them. *And here's why YOU will like them:* They last longer . . . and deliver more and better work per file-dollar. Order Simonds Red Tang Files from your Industrial Supply Distributor, or from the nearest Simonds office listed below.

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Avenue, Portland 4, Ore.; 31 W. Trent Avenue, Spokane 8, Washington; *Canadian Factory:* 595 St. Remi St., Montreal 30, Que.

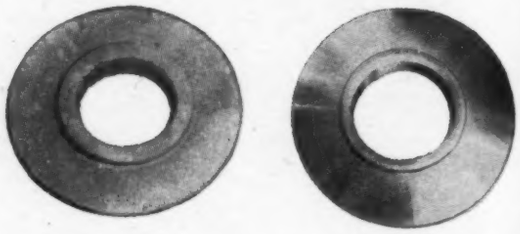


How the *FASTERMATICS* Pay Out Faster, too!

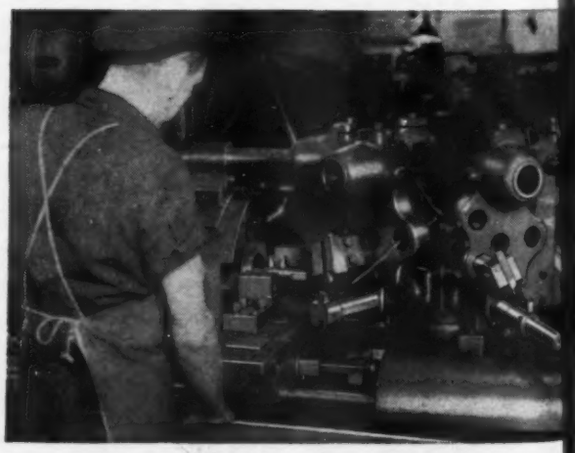
• It may seem incredible, in this day and age, for any major machine tool to "buy" itself in nine weeks' operation. Yet that's exactly what the Fastermatic did on this job of machining clutch plate hubs.

With automatic control of all machine functions, this Fastermatic reduced the former time of 15 minutes per piece, on hand-operated turret lathes, to only 3 minutes, floor to floor. Earnings piled up so fast over former production costs that the Fastermatic paid for itself in only 9 weeks, or 893 hours of operation.

If you have work that will permit a number of cuts to be done in one chucking, investigate what the Fastermatic can accomplish to bring you faster, more efficient production and lower costs. Ask for full information.



Rough Steel Forging *Machined Clutch Plate Hub*



In this tooling set-up, only three turret faces are needed to turn each part. By repeating the tooling on the remaining three faces of the hexagon turret, two parts are machined with each complete turret cycle. The operator has only to load and remove the work.

GISHOLT

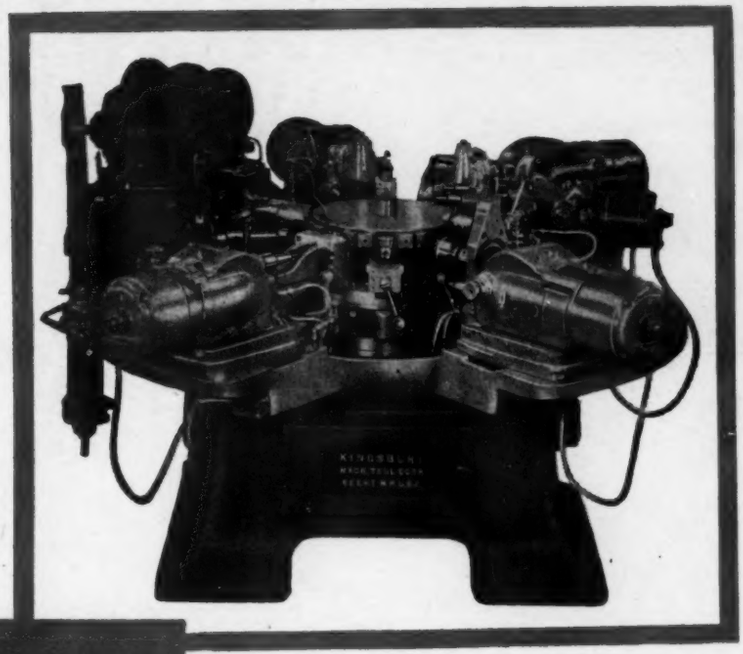
GISHOLT MACHINE COMPANY

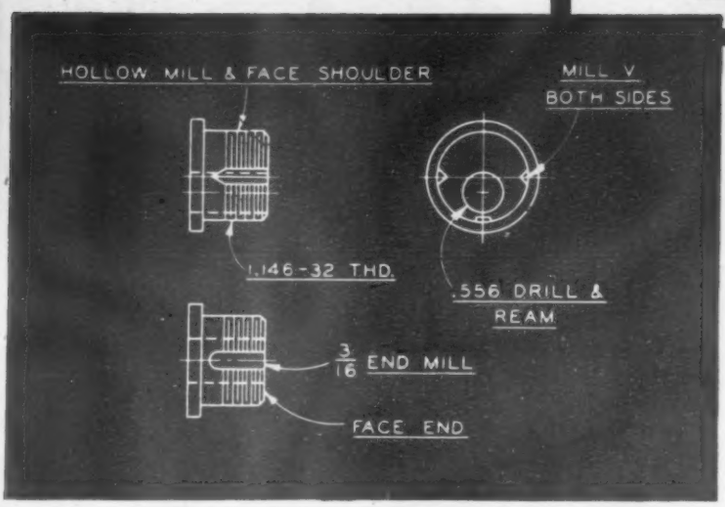
1201 E. Washington Ave. • Madison 3, Wisconsin

Look Ahead...Keep Ahead...with Gisholt

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Ability to handle wildey different operations at top speed proves the value of versatility





THIS IS A FLEXIMATIC SPEED UP JOB

FLEXIMATIC by KINGSBURY

KINGSBURY versatility is well exemplified in the widely different machining operations performed on bronze lock cylinders. For example, note that hollow milling, facing, V-milling, drilling, reaming, end milling and end facing are included in this set-up on a Model GD FLEXIMATIC. By being able to handle all these operations with a *single chucking of the work*, production is stepped up tremendously.

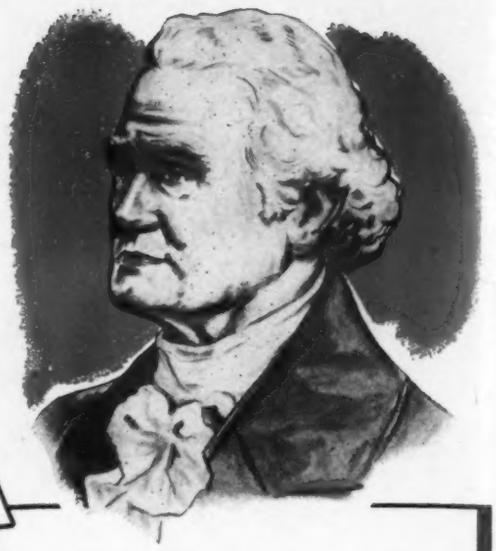
Whether it's a lock part or any other complicated piece of work, the FLEXIMATIC can be depended on to meet exacting requirements. Its versatility is practically unlimited because of the basic nature of the method utilized in building up standard units around an indexing turret, each unit designed for handling a specific operation. Not only does this method provide for a wide variety of operations simultaneously but also makes change-over readily possible to meet the requirements of other jobs which call for still different machining combinations.

Whatever the set-up, high production and utmost precision are assured by FLEXIMATICS.

KINGSBURY MACHINE TOOL CORPORATION
KEENE NEW HAMPSHIRE U.S.A.

Thank You, Mr. Webster

for clearing up the difference between "rebuilding" and "reconditioning" government surplus machine tools.



REBUILD (rē-bĭld), *v.t.* To build again or to construct anew, usually the parts that are in good condition being used; as, to *rebuild* a house, a wall, a typewriter, a wharf, or a city.

RECONDITION (rē-kŏn-dĭsh-ŭn), *v.t.* To restore (something worn) to sound condition by readjustments, and replacement of parts. To renovate; as, a *reconditioned* automobile.

From Webster's New International Dictionary, Second Edition. "THE SUPREME AUTHORITY"

Many of the Government Surplus Machine Tools are ready to use "as is". Many more need rejuvenation before they will function properly. The amount of rejuvenation necessary is the important thing to every prospective purchaser.

Read again the two definitions above. *Reconditioning* and *Rebuilding* are two distinct processes. The former can be undertaken by any good mechanic provided he does not have to replace vital parts. But *rebuilding* is a function that should be entrusted *only to the original builder of the machine.* He alone knows all the details that must be made right before that machine can be expected to deliver the service for which it was designed.

At Pratt & Whitney we are ready to offer you either reconditioning or rebuilding service on Pratt & Whitney machine tools. If you are looking for one of our machines we urge you to contact our nearest branch office at once. Our men can help you right from the start . . . help establish specifications for the machine you need . . . help you locate it by working with the RFC office. They will help you make sure that you are not getting a "special" machine that will require so much alteration that a new machine would cost you less . . . make sure that the machine you do buy is good for many years of efficient, economical service.

Call upon your Pratt & Whitney Branch Office for this help, this guidance. They are organized to serve you under our Approved Dealer arrangement with the government War Assets Corporation.

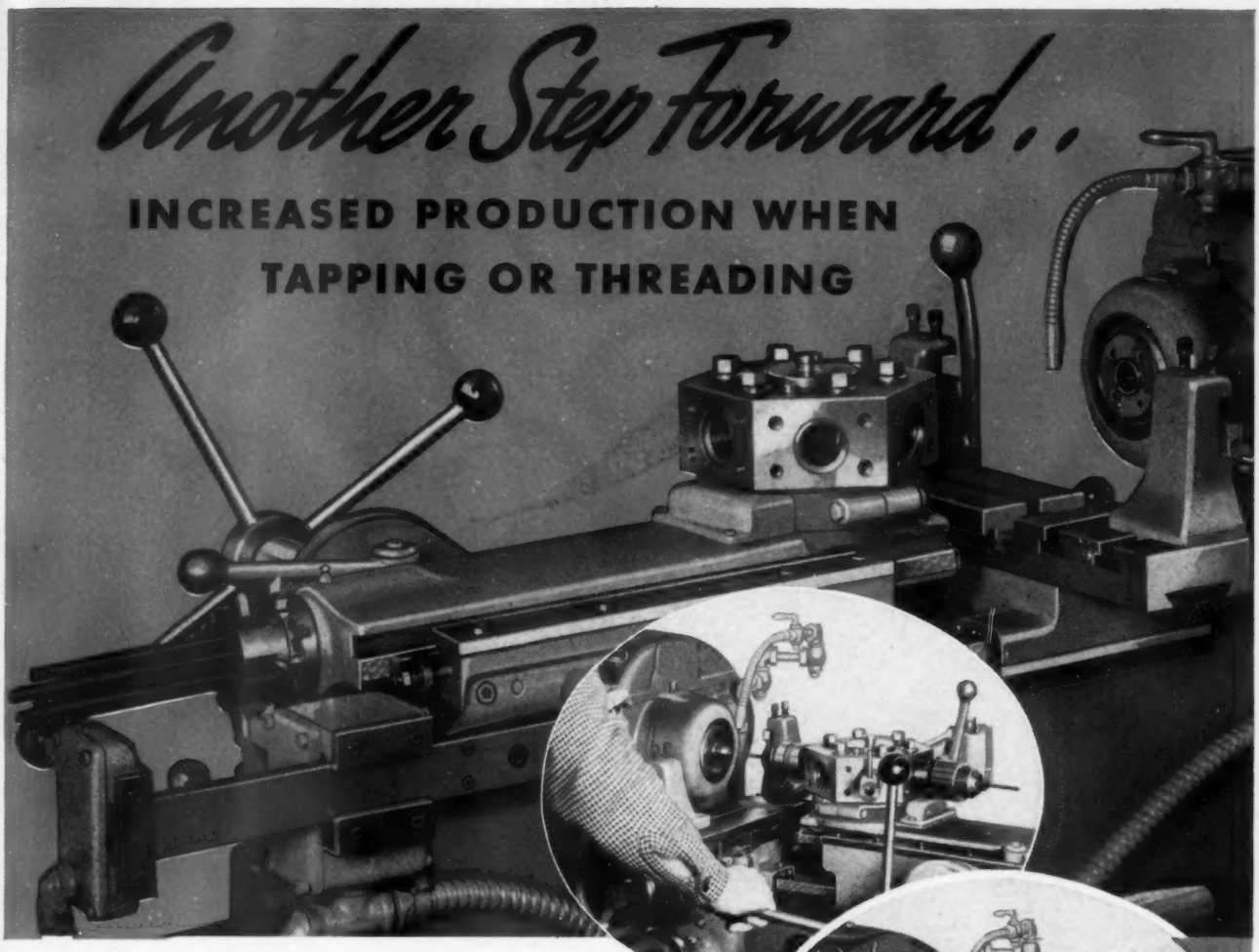
PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD 1, CONNECTICUT

Another Step Forward . .

INCREASED PRODUCTION WHEN TAPPING OR THREADING



WHEN tap reaches the desired depth, the spindle automatically reverses. Then after the tap has backed out, spindle rotation again changes automatically to the original direction.

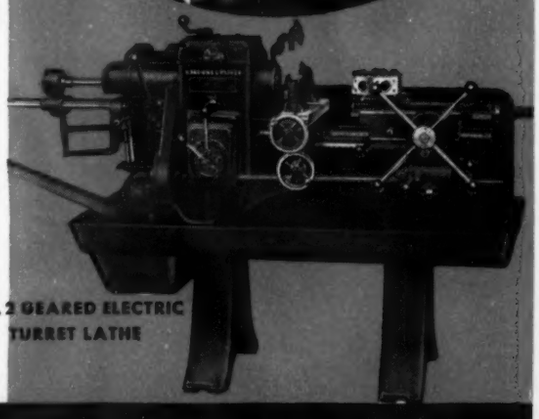
The automatic reverse is controlled by adjustable dogs on the independent stop screw drum of the turret slide, and will control the reversal to within a few thousandths of an inch of turret slide travel.

An automatic 2 to 1 speed change may be similarly obtained, and is a convenient time saver between turning and threading, or between drilling and reaming operations.

Our No. 1 and No. 2 Geared Electric Turret Lathes are now offered with either one or both of these job speeding features.

We will gladly furnish additional information on request.

No. 1 GEARED ELECTRIC TURRET LATHE



No. 2 GEARED ELECTRIC TURRET LATHE

BARDONS & OLIVER, INC.

1133 WEST 9TH STREET • CLEVELAND 13, OHIO

What This Simple Test Shows You About SUPERFINISH

Take a ground shaft (finish ground if you like) and scratch a match on it. The match will light. Why? Because there is enough surface roughness to abrade the sulphur tip—to cause friction and heat. These same ridges can penetrate an oil film and cause friction on bearing surfaces. Surface roughness is 20 micro-inches, R.M.S.

Make the same test on a Superfinished *surface. The match won't ignite. There is nothing to create friction. Here is a degree of smoothness that will support and maintain a uniformly thin oil film—without ridges to penetrate and abrade the mating surface. The life of such a bearing surface is unlimited. Surface Superfinished to 3 micro-inches, R.M.S.*

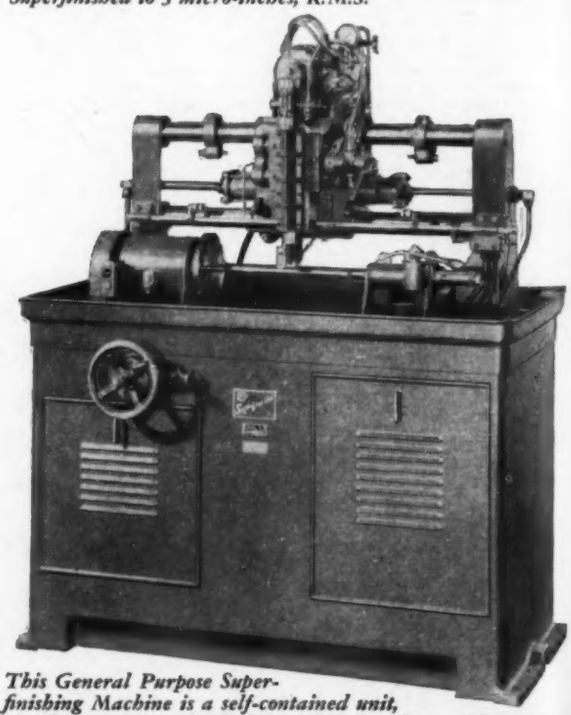
Removing grinder scratches, feed spirals, chatter marks, and partially loosened metal splinters by *Superfinishing* is a very quick and inexpensive operation. These finely finished surfaces are a real economy because they not only reduce friction and wear to a new minimum, but they also eliminate the most common bearing troubles. And surprisingly enough, *Superfinishing* may actually cut your manufacturing costs as well—by eliminating other more expensive processes involved in producing smooth finish.

Gisholt engineers are ready to give you facts about this important development.

GISHOLT MACHINE COMPANY
1201 East Washington Avenue
Madison 3, Wisconsin

GISHOLT

Look Ahead
Keep Ahead
with Gisholt



This General Purpose Superfinishing Machine is a self-contained unit, simple to operate and ideally suited to handle a wide range of miscellaneous or production work. Other sizes and types are available, as well as Superfinishing attachments for lathes.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

KEMPSMITH

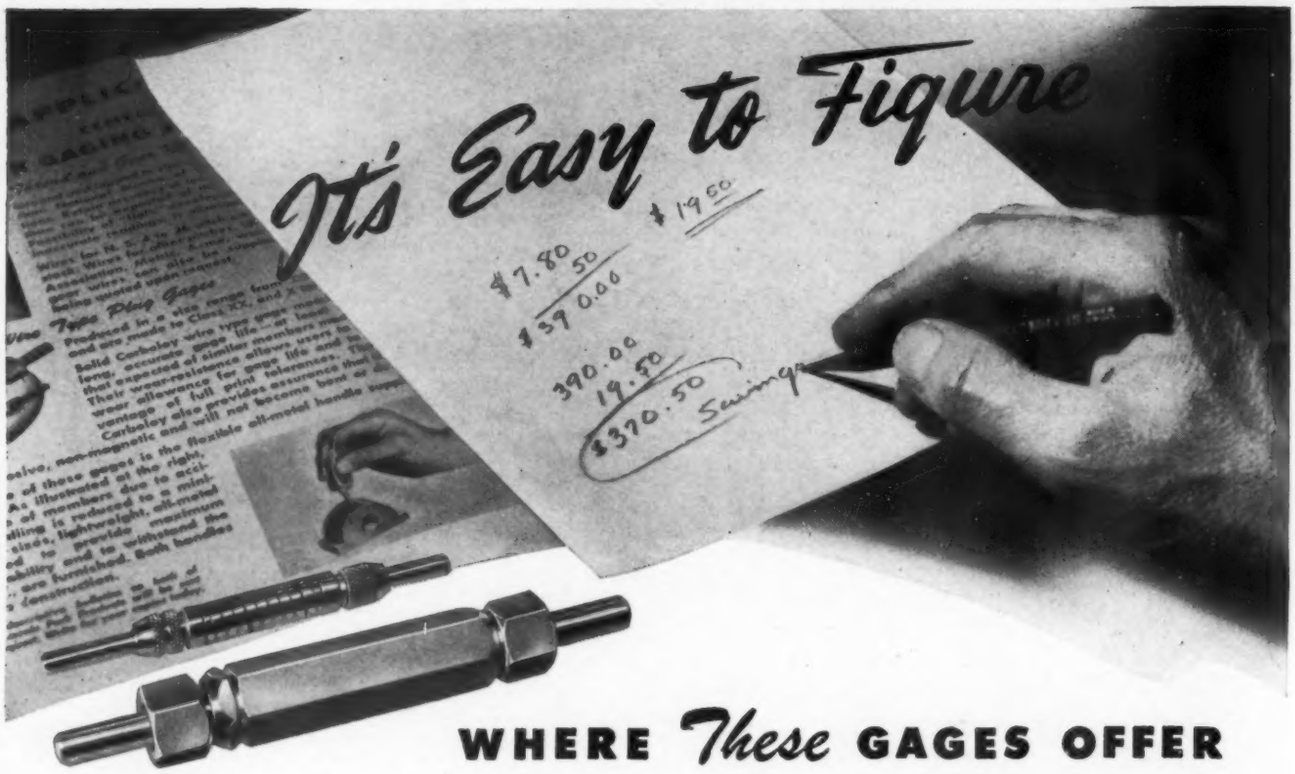
MILLING MACHINES

for Toolroom and Production Milling!

For 58 years, Kempsmith has been a by-word for supremacy in milling machines. Kempsmith's *mature experience* is now building milling equipment that assures production victories. Ruggedness, precision and ability to take heavy cuts smoothly, make Kempsmith Milling Machines ideal for production, tool room or general purpose milling. A complete line of standard attachments and accessories, constructed with the same degree of accuracy and sturdiness that is built in the Kempsmith Millers, contributes flexibility and unusual economy. Write for bulletins No. 102 — Type G Milling Machines; No. 119 — Universal Dividing Heads; No. 105 — Vertical Milling Attachments; No. 113 — Hi-Speed Universal Milling Attachments; No. 106 — Circular Milling Attachments; No. 117 — Milling Machine Vises; No. 107 — Slotting Attachments; No. 116 — Arbors and Accessories.

THE KEMPSMITH MACHINE CO., MILWAUKEE 14, WIS., U. S. A.

• *Precision Built Milling Machines Since 1888* •



WHERE *These* GAGES OFFER *Tremendous Savings* IN INSPECTION COSTS

If you use plug gages under 3/8" diameter, you owe it to yourself to compare these Lincoln Park gages—in eventual cost, lasting accuracy and practicability—with any other gages used for the same purpose.

Lincoln Park Wire Type Plug Gages made of cemented-carbide are approximately two and one-half times the price of similar gages made of steel. But the accurate service life of these gages is at least fifty times greater than can be expected of the best steel gages. This in itself represents sizeable savings in actual dollars and cents.

In addition, there are many other important advantages—offering even further inspection economies. Complete information on Lincoln Park Wire Type Plug Gages is contained in a new bulletin—yours for the asking.

Also New! **THREAD AND GEAR MEASURING WIRES**

. . . made of cemented carbides. Ground and lapped to standard tolerances closer than N.B.S. specifications. Retain accuracy fifty times longer than steel wires. Write for new bulletin.

Lincoln Park INDUSTRIES, INC.

1721 FERRIS AVENUE • DETROIT 25, MICHIGAN

HOW A DISSTONEER CUT COSTS 25% ON A MACHINE HACK SAW OPERATION

A manufacturer was cutting nine different types of steel and other metals, using the same kind of hack saw blade for each operation . . . and with very unsatisfactory results. Cuts ran crooked, teeth would strip, and blades had to be changed every six hours.

A Disstoneer*, called in for consultation, saw at once that, because of the nature of the work and the varying degrees of hardness of the metals, the strain on the blade was exceptionally severe. Obviously a much tougher and stronger blade was needed . . . one that would stand up under extra abuse. He recommended the use of Di-Mol hack saw blades—general purpose blades developed by extensive research and experimentation.

The result was an immediate improvement. Operation was more satisfactory, cuts were straight and made more quickly, and on one tough alloy the life of the blade was increased to eight hours instead of six, more on other metals—a saving of 25% and upward in blades alone.

Another clear-cut case of Disston leadership

*DISSTONEER—a man who combines the experience of Disston leadership and sound engineering knowledge, to find the *right tool* for you—to cut wood, to cut metal and other materials—and TO CUT YOUR COST OF PRODUCTION—*not only on special work, but on ordinary jobs as well.*

Instead of using hack saws, your metal-cutting may be done with band saws. If so, you will be interested in—

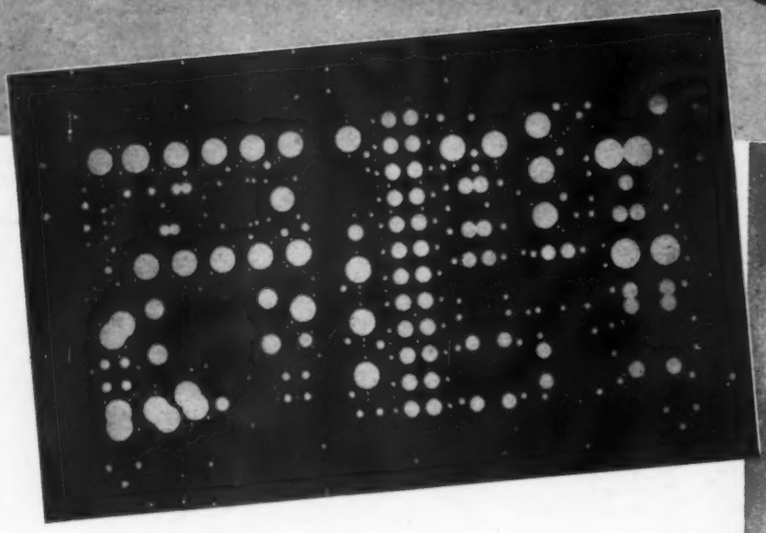
DISSTON METAL CUTTING BAND SAWS

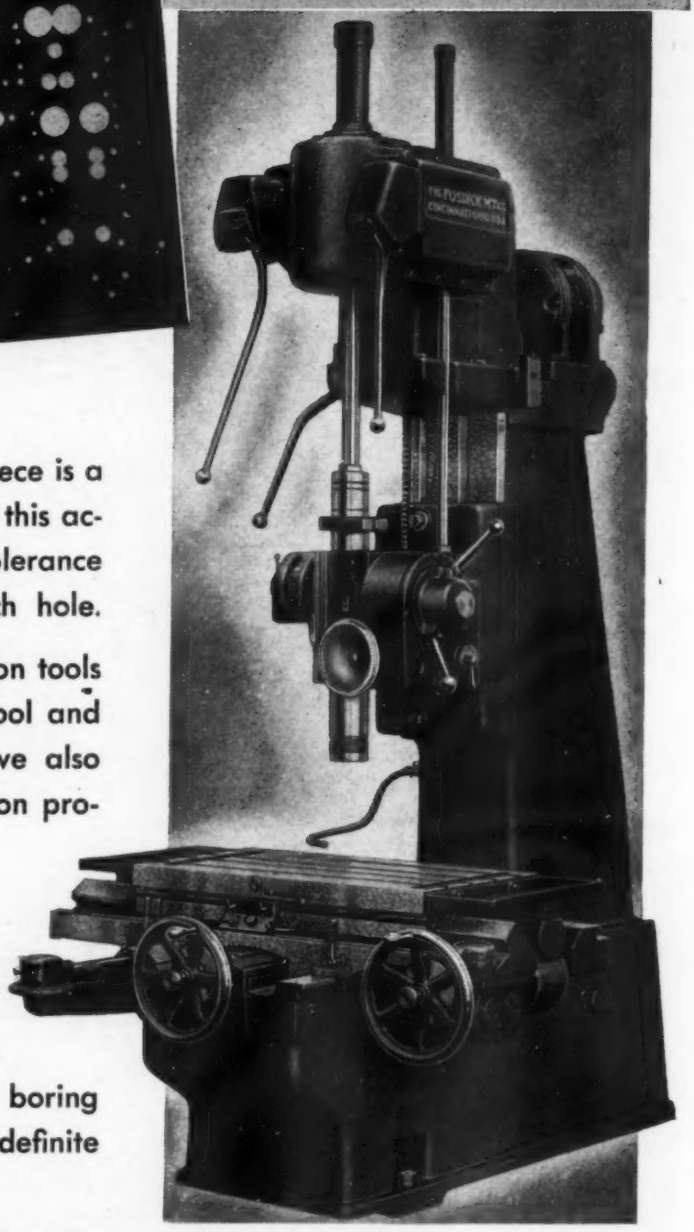
If the materials you cut include thin sheet steel, aluminum, plastics or similar materials, you will find many distinctive advantages in Disston *hardened throughout* band saws. They stand up at high speeds, and can be resharpened by filing. For general metal cutting, at slow speeds, the Disston *hard edge flexible back* band saw gives excellent service . . . and with maximum economy.

HENRY DISSTON & SONS, INC., 420 Tacony, Philadelphia 35, Pa., U. S. A.

385 Holes held to .0002" tolerance on a

FOSDICK Jig Borer





● The drilling of 385 holes in a work piece is a good sized order in itself. Not only was this accomplished on a Fosdick Jig Borer but a tolerance of .0002 inch was maintained on each hole.

Fosdick Jig Borers are essentially precision tools designed primarily for tool room and tool and die shop operations. However they have also proved both successful and economical on production work requiring exceptional accuracy. This is particularly true of runs which would not warrant an investment in costly jigs and fixtures.

The flexibility of the machine adapts it to a wide range of drilling, reaming, boring and even light milling operations to definite precision tolerances.

For complete construction details and operation data write for Fosdick Jig Borer Bulletin J. B. A.

FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23, ··· OHIO

How do induction and dielectric heating work?

What are their advantages and limitations?

Where can you use them?

How do r. f. generators compare with motor-generator and spark gap units?

Now you can get the facts with this new book

The answers are all here in this new fact-packed book by Westinghouse . . . including full-color illustrations and 14 case histories of induction and dielectric heating . . . brazing, annealing, hardening, soldering, plastic molding, rubber curing, plywood bonding. Write today for your copy on your business letterhead, please. Ask for B-3620. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

J-08161

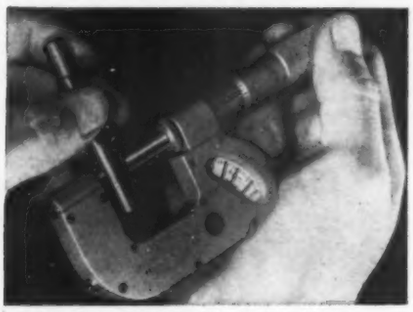
Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

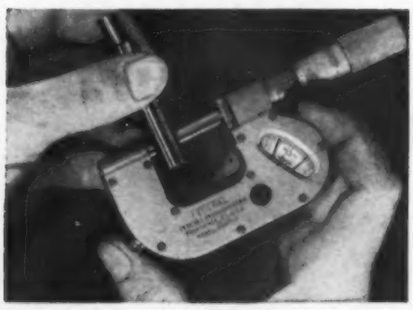
Electronics at Work

THE MICROMETER YOU HAVE BEEN WAITING FOR

THE FEDERAL INDICATING MICROMETER



USED AS A MICROMETER — spindle is brought into contact until Indicator reads "O".



USED AS A GAGE — push button retracts anvil and dimension is checked on dial.

. . . Has Many Advantages Over Usual Type Micrometers

This new Federal Indicating Micrometer combines the precision of the Dial Indicator for uniformity of contact pressure and for use as a comparator, with the accuracy of the micrometer thread for measuring.

You do not need the skill of a toolmaker to operate it accurately. The Dial Indicator insures uniform contact pressure.

It takes the place of a complete set of "go and no-go" gages, because you can set it to the required size, clamp it in that position, and gage your batch of workpieces.

Anvil is retractable. Both contacts are Tungsten Carbide tipped.

It is light, easy to handle, and much easier to read.

Write for descriptive folder to —

FEDERAL PRODUCTS CORPORATION

1144 EDDY ST., PROVIDENCE 1, R. I.

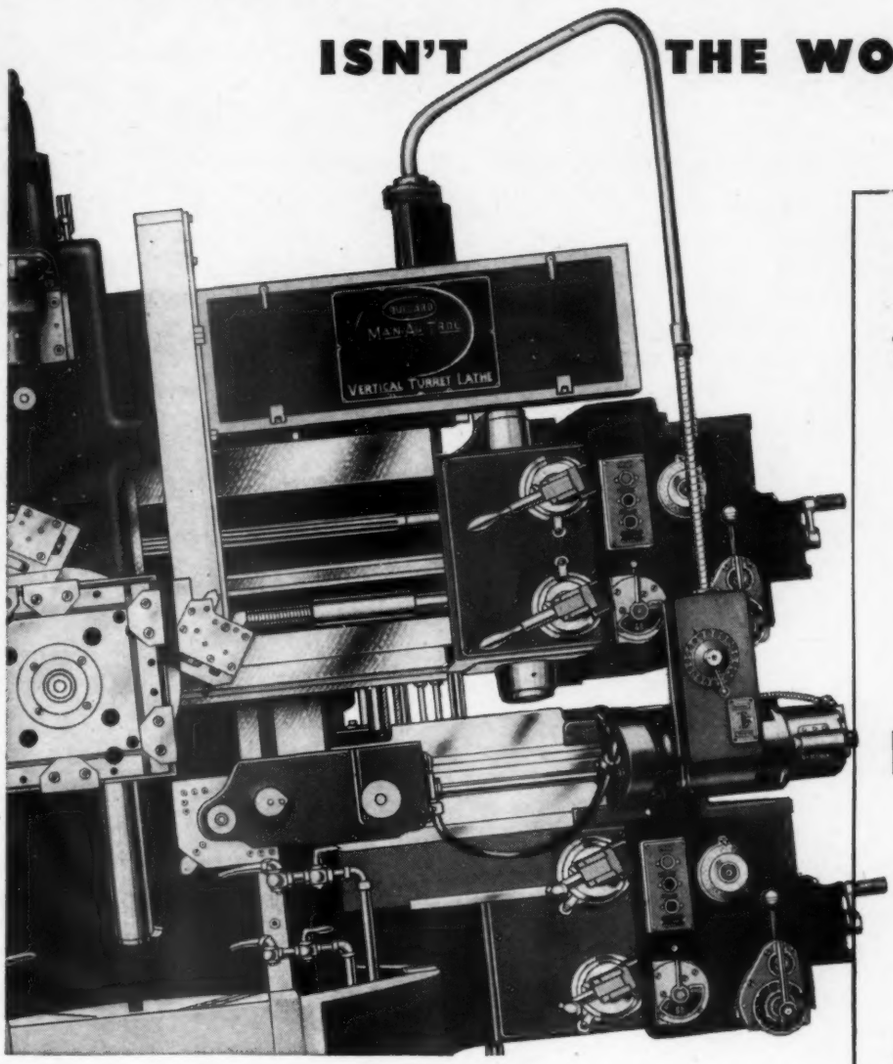
Color Films Available No. 1 Dial Indicators. No. 2 Dial Indicator Gages. Fer instruction and training. Loaned on request.

FEDERAL MECHANICAL AIR and ELECTRONIC GAGES

PRECISION MEASURING INSTRUMENTS

Reconversion

ISN'T THE WORD FOR IT!



Reconversion means changing *back*. What business needs today is to change *forward* . . . to new machines and new methods that will increase output per man-hour . . . thus lowering unit costs so that more and more people can buy.

That is the only way higher wages and more jobs can be created while business retains the adequate return on investment that pays for the new machines and new methods. The Bullard Company, Bridgeport 2, Connecticut.

BULLARD
MAN-AU-TROL
MASTER OF THE MACHINE

BULLARD CREATES
NEW METHODS
TO MAKE MACHINES DO MORE

for example:

See how the

BULLARD MAN-AU-TROL

Vertical Turret Lathe lowers unit production costs

Lightens Labor's Load. Operator machines one piece manually, setting production method into automatic cycle; then merely loads, supervises and unloads while MAN-AU-TROL does the work.

Makes Automaticity Versatile. Automatically handles any work within manually-operated scope of Vertical Turret Lathe. Converts instantly to manual operation on same or entirely different piece without affecting automatic cycle.

Saves Set-up Time. Set-up time from one class of work to another is only slightly more than for a manually-operated machine.

Reduces Salvage Cost. Machines day after day with consistent accuracy not obtained under manual operation.

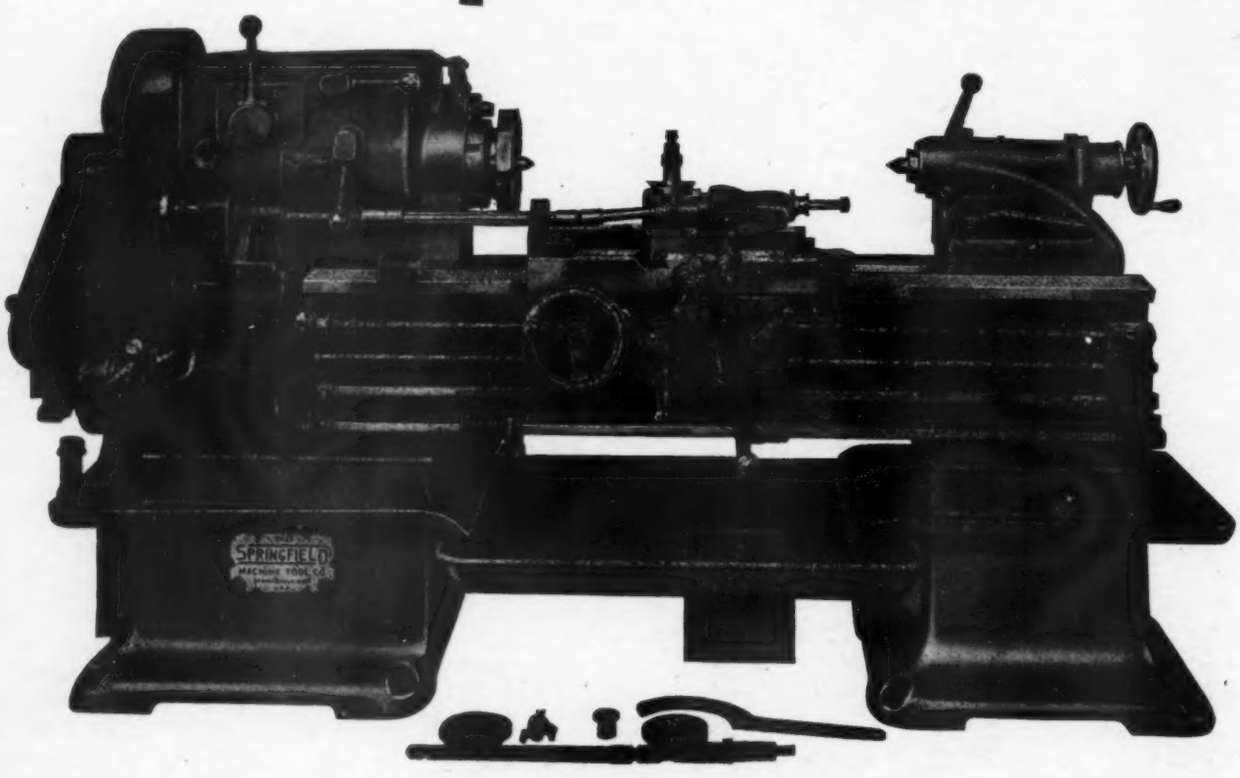
"from the ground up"
a superior lathe!

Choose SPRINGFIELD
GEARED HEAD LATHES

All heavy castings in SPRINGFIELD Lathes, including the bed, are cast in our own foundry. Gearing is carefully engineered to deliver maximum efficiency for years. Attachments, many of which we feel demonstrate unusual engineering ingenuity, are designed for practical usefulness. Lubricating and power transmission systems are rugged, trouble-free. Check the records of SPRINGFIELD Lathes in other shops—then judge their capabilities and quality for yourself.

Get complete information—write for our new bulletins.

THE SPRINGFIELD MACHINE TOOL COMPANY
Springfield, Ohio



THE SPRINGFIELD MACHINE TOOL COMPANY

The New HARDINGE High Speed Precision Second Operation Machine

You need this machine for rapid and accurate production of parts requiring secondary operations

1" COLLET CAPACITY
9" SWING; SPEEDS TO 4000 R.P.M.

Above is a typical production run. The cross slide has a lever turning slide and a multiple tool bit holder. The turret is double-tooled — *all standard tooling for quick set-up.*

Other features are: Hardened and ground steel dovetail ways, Hardinge center-drive preloaded ball bearing spindle, preloaded ball bearing turret head and hardened and ground turret slide ways. Write for bulletin DSM59 regarding additional features.

HARDINGE BROTHERS, INC.
ELMIRA, N. Y.

Modern Cleveland Single Point Presses

FOR

SPEED • ACCURACY • EASE OF OPERATION

These two Cleveland Single Point Presses, which are designed with single connections located in the center of the slides, are typical of this Modern line which also embraces Two Point Presses having two connections and Four Point Presses having four connections, and each of the three types can be furnished in sizes and capacities to suit particular requirements.

The design of these Modern Cleveland Presses not only contributes to greater rigidity and ruggedness but to extreme accuracy in the production of duplicate parts and a considerable saving in overall floor space.

The 1-28-200 has a capacity of 200 tons while the 1-36-250 has a capacity of 250 tons.

Modern Presses THE CLEVELAND PUNCH & SHEAR WORKS COMPANY, *Cleveland, O.*

New rigidity and power for today's cutting materials

Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER
SPECIAL MACHINES

NEWTON 8 SPINDLE TWO-STATION UNIT HEAD ROTARY MILLING MACHINE

Designed for high production milling of Automotive Cylinder Blocks and heads, transmission cases, and similar parts, this machine is equipped with two sets of roughing and two sets of finishing spindles with operating stations on each side of the machine, making possible twice the productive capacity of the conventional single station machine.

Send us your inquiries

BUILDERS OF RAILROAD SHOP TOOLS SINCE 1861

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK

Sidney Lathes

★

TOOL & DIE WORK

★

COMPLICATED LATHE WORK

★

PLAIN TURNING

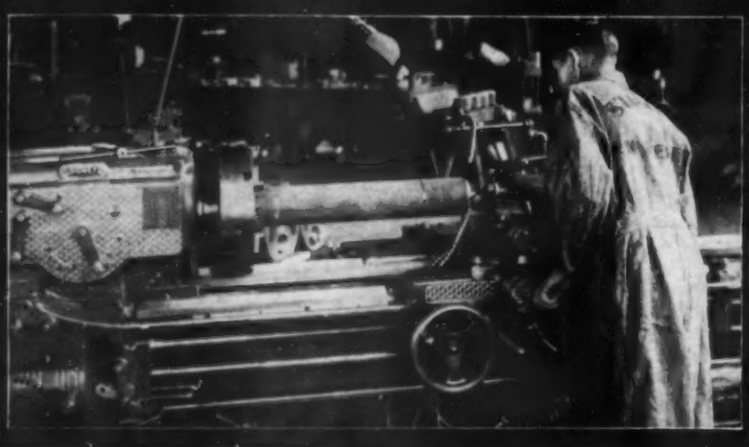
★

● The smooth flowing power of the continuous tooth Herringbone geared headstock, ease and convenience of controls, the rigidity of 4 wall bed construction all contribute to the accuracy, productive capacity and smooth finish obtained from Sidney Lathes.

They are also a few of the important construction features responsible for Sidney Lathe's adaptability to tool and die work—complicated lathe operations—or straight turning.

For all around utility—precision—and dependability make your next lathe a Sidney.

Bulletins on all sizes available



Builders of Precision Machinery

THE SIDNEY MACHINE TOOL COMPANY

SIDNEY • OHIO

SIDNEY

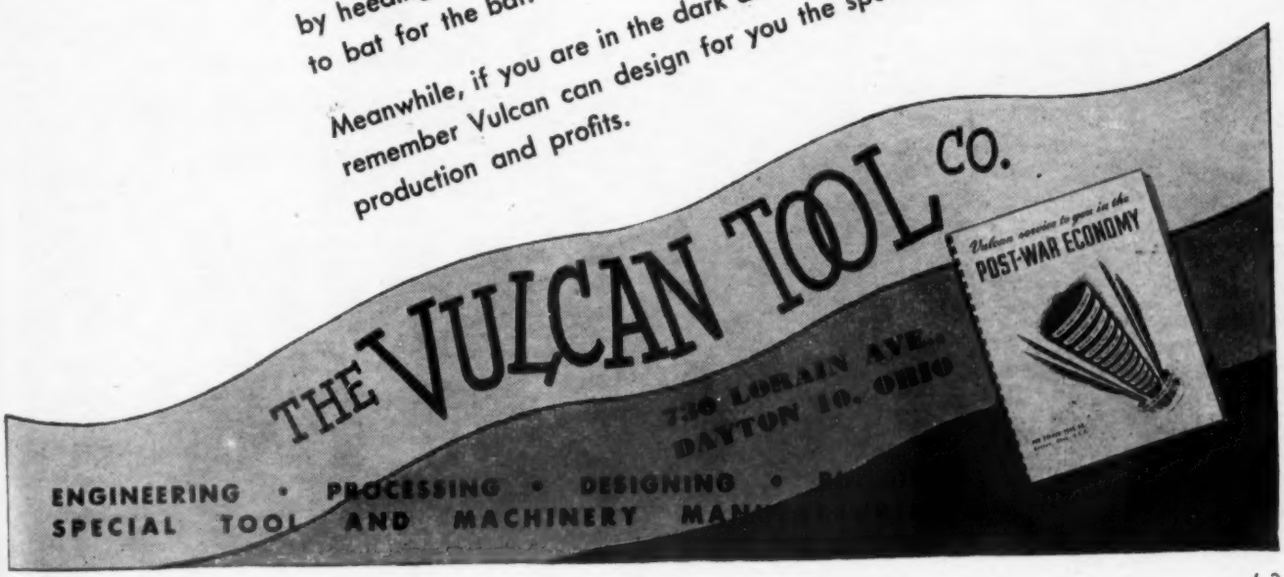
ESTABLISHED 1904

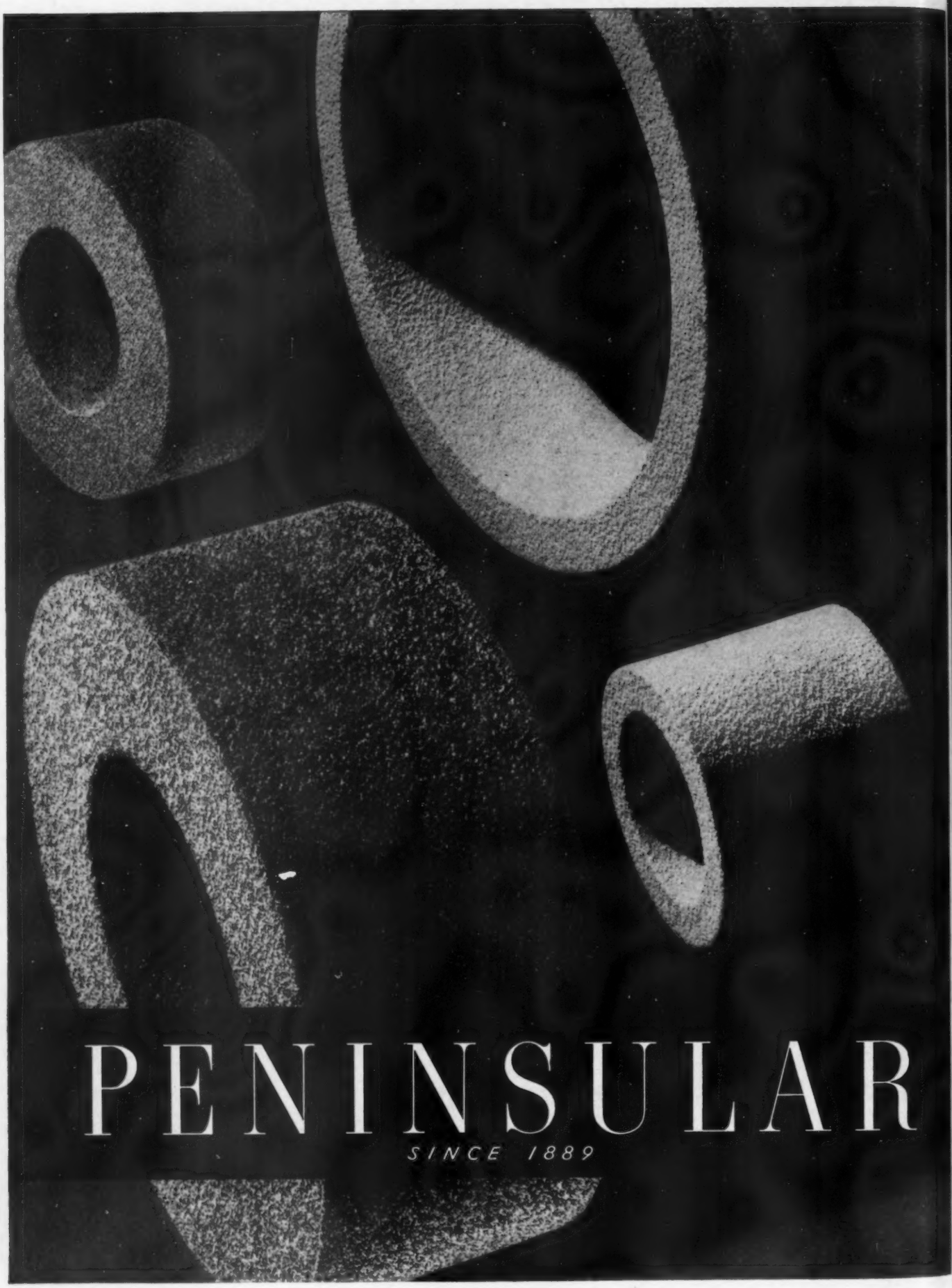
WE GO TO BAT FOR THE RADAR INVENTOR!

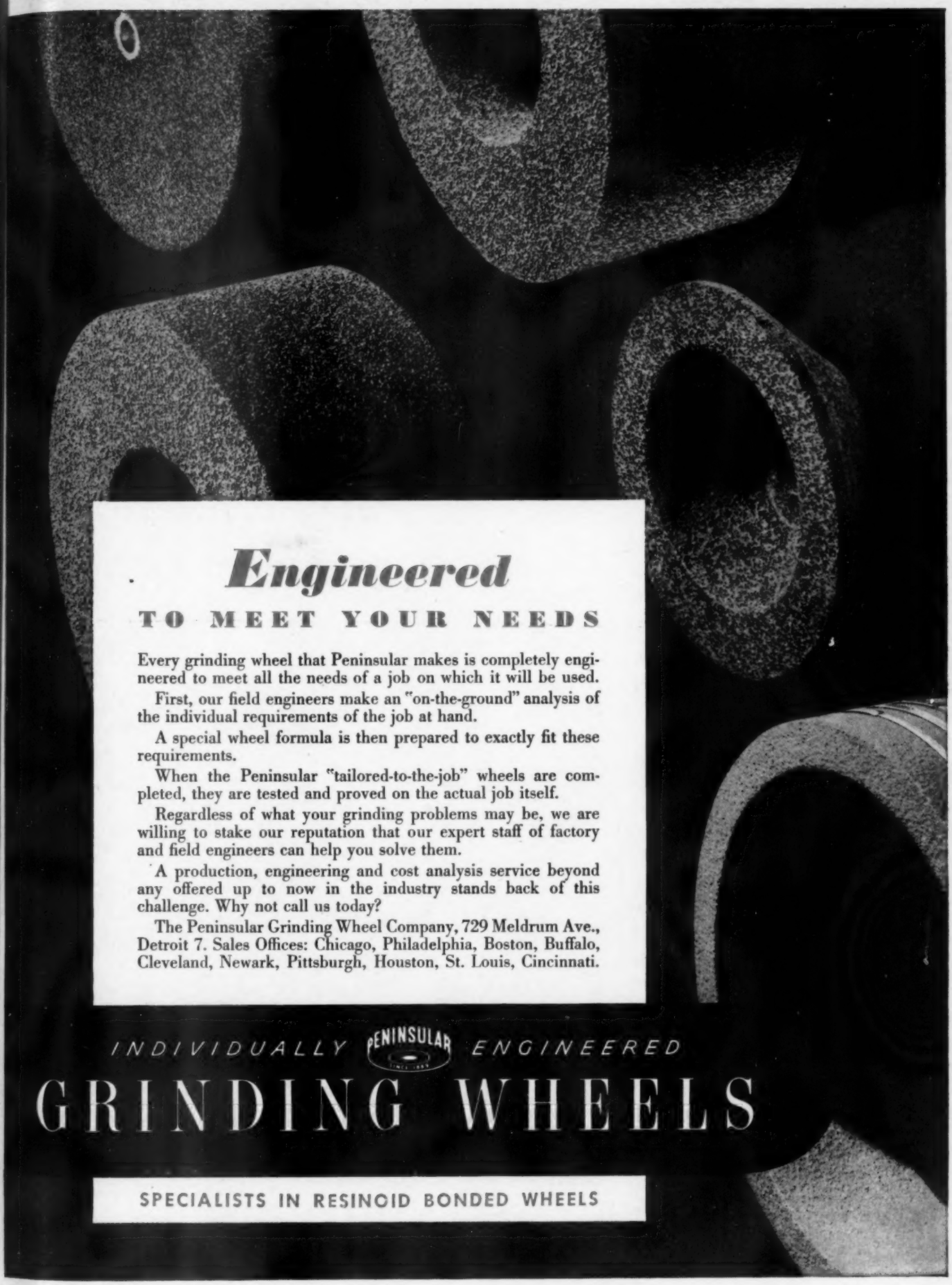
You have been pitying the poor dumb beasts shown in recent Vulcan advertisements because they couldn't invent tools with which to overcome their limitations. Perhaps you've been thinking how much men who fail to design better tools are like the poor dumb beasts.

Well, scientists, also "Collier's Weekly" have recently said that 60,000,000 years ago the poor blind bat invented a radar system of his own. He sends out supersonic cries on a shorter wave length than our auditory range. Thus he guides himself through the darkness and avoids collisions, by heeding the echoes that rebound from objects in his path. So we go to bat for the bat.

Meanwhile, if you are in the dark about how to make more money faster remember Vulcan can design for you the special tools that can increase production and profits.


THE VULCAN TOOL CO.
736 LORAIN AVE.
DAYTON 10, OHIO
Vulcan service to you in the
POST-WAR ECONOMY
ENGINEERING • PROCESSING • DESIGNING •
SPECIAL TOOL AND MACHINERY


PENINSULAR
SINCE 1889



Engineered

TO MEET YOUR NEEDS

Every grinding wheel that Peninsular makes is completely engineered to meet all the needs of a job on which it will be used.

First, our field engineers make an "on-the-ground" analysis of the individual requirements of the job at hand.

A special wheel formula is then prepared to exactly fit these requirements.

When the Peninsular "tailored-to-the-job" wheels are completed, they are tested and proved on the actual job itself.

Regardless of what your grinding problems may be, we are willing to stake our reputation that our expert staff of factory and field engineers can help you solve them.

A production, engineering and cost analysis service beyond any offered up to now in the industry stands back of this challenge. Why not call us today?

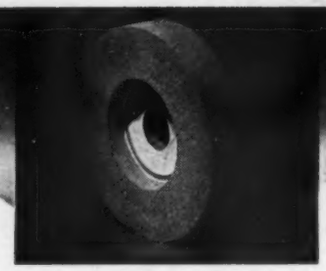
The Peninsular Grinding Wheel Company, 729 Meldrum Ave., Detroit 7. Sales Offices: Chicago, Philadelphia, Boston, Buffalo, Cleveland, Newark, Pittsburgh, Houston, St. Louis, Cincinnati.

INDIVIDUALLY PENINSULAR ENGINEERED

GRINDING WHEELS

SPECIALISTS IN RESINOID BONDED WHEELS

Proven QUALITY



Proven quality and dependability of performance are hallmarks of the products of the Mid-West Abrasive Company.

Mid-West's outstanding successful tool room grinding wheel, and every other product of the broad Mid-West line—honing stones, sharpening stones, coated abrasives, disks and wheel dressers—all must bear these two hallmarks.

Let engineered quality and dependability guide you in your choice of abrasives, and we feel certain that choice will be Mid-West. Prompt delivery on all items.

MID-WEST ABRASIVE CO.

Manufacturers of DEPENDABLE Abrasives

Owosso, Mich. • Detroit • Rochester, Pa.

Figure what it would cost you to build up this section

This Alcoa Aluminum extruded shape is produced in 80-foot lengths.

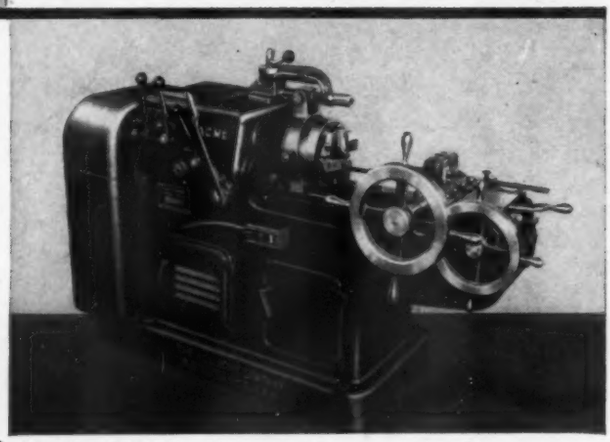
This shape forms the side sill of a railway passenger car. It provides extensions needed for attachment of every part. It is strong and dependable, yet doesn't contain a single pound of *needless* weight.

To build up this section, you'd probably rivet together channels, angles, and Z's. You'd have excess metal where one section overlapped another. You'd have the added weight of rivets. You'd pay for many hours of labor to assemble it. As one Alcoa customer put it, "We can't afford *not* to use extruded shapes."

For help on figuring how you can use Alcoa Aluminum extruded shapes to best advantage, call the near-by Alcoa office. Or write ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh 19, Pa.

ALCOA FIRST IN **ALUMINUM**

10 USES *for an* ACME XL



1. STRAIGHT THREADING
2. TAPER THREADING
3. COARSE THREADING (multiple cuts)
4. SHOULDER THREADING (with minimum clearance)
5. PIPE AND NIPPLE THREADING
6. HOLLOW MILLING (continuous and undercut)
7. BOLT POINTING
8. BOLT FACING
9. TAPPING
10. REPETITIVE ACCURACY

HILL ACME TOOLS FOR INDUSTRY

The micrometer adjustment of the die head (exclusive on ACME XL Threading Machines) insures exact duplication on every piece entailing a threading operation. ACME XL machines are built in sizes from 1" to 3" inclusive.

THE HILL ACME COMPANY

ACME MACHINERY DIVISION • 4535 St. Clair Ave. Cleveland 14, Ohio
ESTABLISHED 1882

FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" HYDRAULIC SURFACE GRINDERS "CANTON" ALLIGATOR SHEARS AND PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES AND SHEAR BLADES

YOU CAN SHAVE A GEAR A LOT FASTER than you can grind it

Gears requiring 40 minutes (floor to floor) for grinding are being shaved in just 5 minutes.

The shaved gears are just as accurate dimensionally as the ground gears; tooth surfaces are just as smooth and of equal if not greater importance, the shaved gear teeth are entirely free of those prevalent hairline grinding cracks which so often result in fatigue failures. Thus by shaving you get better gears faster and at less production cost.

Gears are shaved on Red Ring Rotary Shaving Machines which produce smooth tooth surfaces and correct errors of helical angle, profile and eccentricity. Gears from 3/16" to 220" P. D. can be shaved. Those from 3/8" to 36" P. D. can also be crowned to avoid the danger of failure due to "End Bearing."

NATIONAL BROACH AND MACHINE CO.

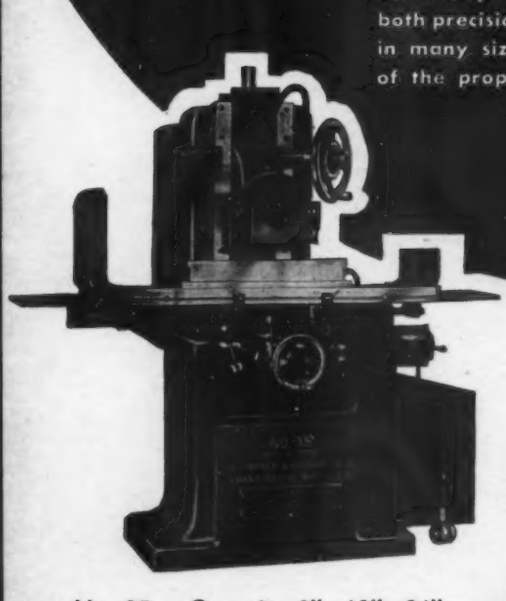
5600 ST. JEAN — RED RING ◯ PRODUCTS — DETROIT 13, MICH.

SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE

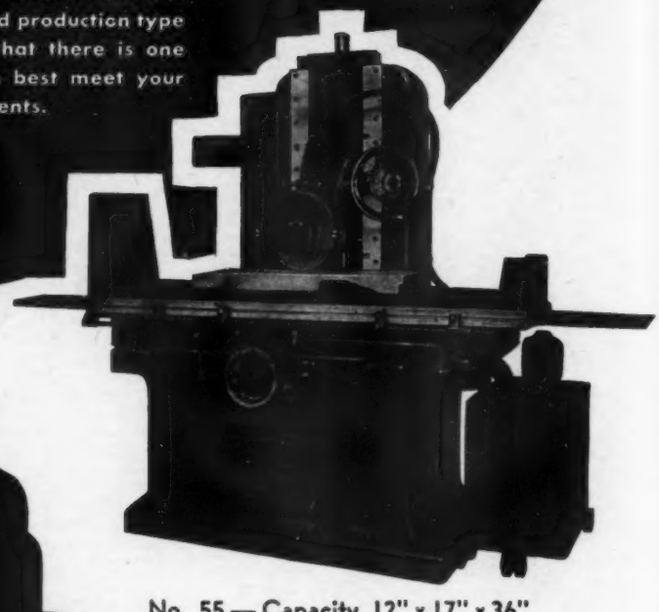
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

GRAND RAPIDS
HYDRAULIC FEED SURFACE
Grinders

GALLMEYER & LIVINGSTON COMPANY is today building what is without question the finest, smoothest, and fastest Hydraulic Feed Surface Grinders of their entire career — a direct result of over 35 years of experience in the design and production of high grade precision grinding machinery. These machines are manufactured in both precision tool room type and production type in many sizes with the result that there is one of the proper size and type to best meet your particular requirements.



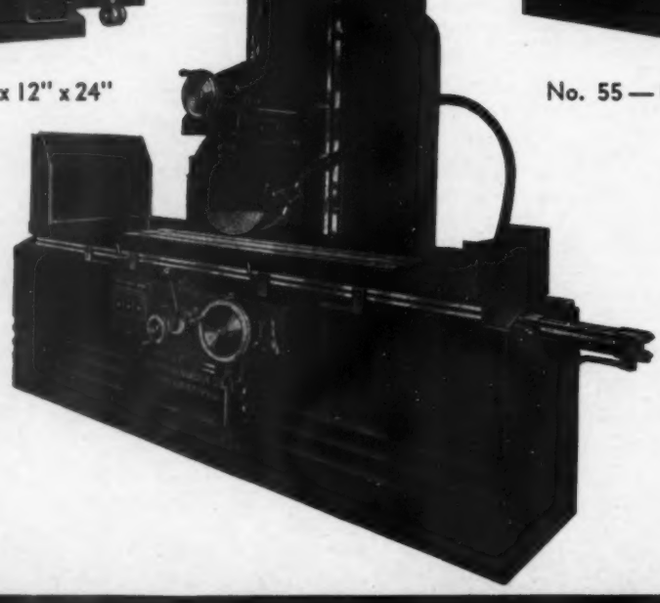
No. 35 — Capacity 8" x 12" x 24"



No. 55 — Capacity 12" x 17" x 36"

Precision Tool Room Type Machines

This is the type of GRAND RAPIDS Hydraulic Feed Surface Grinder on which one prominent machine tool builder obtains a 5 micro inch finish operating machine at 125 feet per minute. They are illustrated and described in bulletin GL-100.



Production Machines

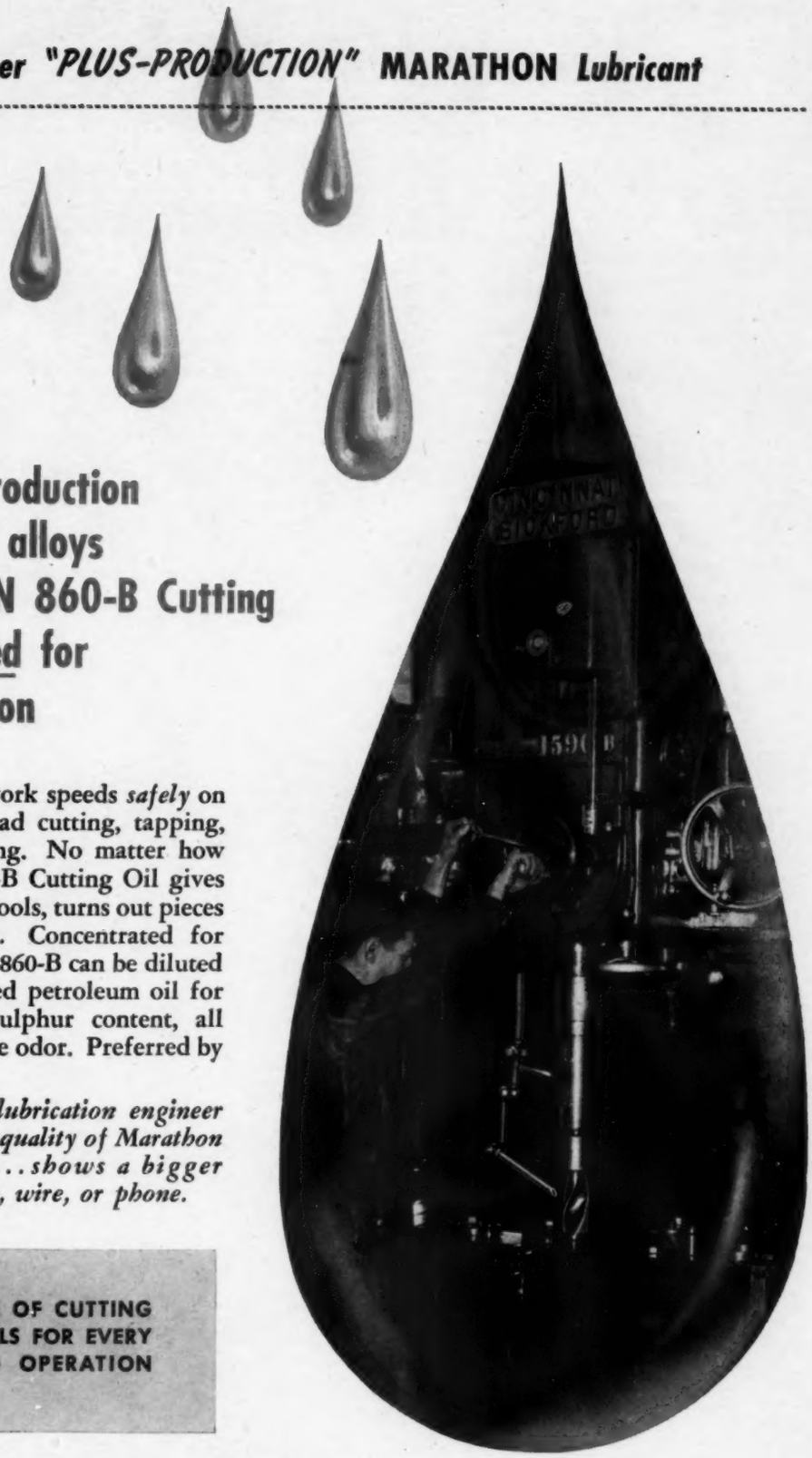
GRAND RAPIDS Production Type Hydraulic Feed Surface Grinders manufactured by the GALLMEYER & LIVINGSTON COMPANY are designated as Model F and Model A and feature the use of wide faced wheel and cross traveling head. GRAND RAPIDS Production Type Hydraulic Feed Surface Grinders are illustrated and described in bulletin GL-4-1-43. Write for your copy today.

GALLMEYER & LIVINGSTON CO.

330 STRAIGHT AVE. S.W.

GRAND RAPIDS, MICHIGAN

860-B . . . another *"PLUS-PRODUCTION"* MARATHON *Lubricant*



Get increased production on the toughest alloys with MARATHON 860-B Cutting Oil...concentrated for tool life protection

Increase tool life, step up work speeds *safely* on all heavy duty broaching, thread cutting, tapping, heavy turning and deep drilling. No matter how tough the alloy, Marathon 860-B Cutting Oil gives you a surplus of protection for tools, turns out pieces with improved finish . . . *faster.* Concentrated for extra cutting quality, Marathon 860-B can be diluted with 1 to 25 parts of low-priced petroleum oil for less demanding jobs. High sulphur content, all *active* sulphur. No objectionable odor. Preferred by machine operators.

Let an Ohio Oil Company lubrication engineer show you how the extra cutting quality of Marathon 860-B cuts final costs, too . . . shows a bigger finished-piece profit. Just write, wire, or phone.

A COMPLETE LINE OF CUTTING AND GRINDING OILS FOR EVERY METAL WORKING OPERATION

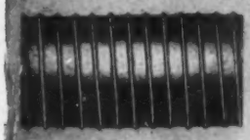
THE OHIO OIL COMPANY

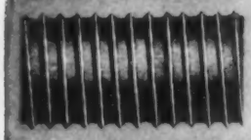
GENERAL OFFICES: FINDLAY, OHIO

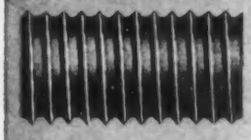
District Offices: Robinson, Ill., Indianapolis, Ind., Louisville, Ky.

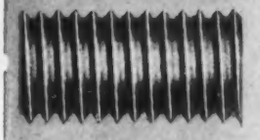
MARATHON PRODUCERS OF PETROLEUM SINCE 1887

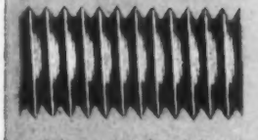
DEVELOPMENT OF THREAD AFTER PROGRESSIVE CUTS

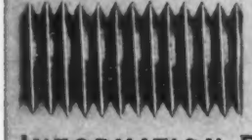

After Cut No. 1


After Cut No. 3


After Cut No. 5


After Cut No. 7

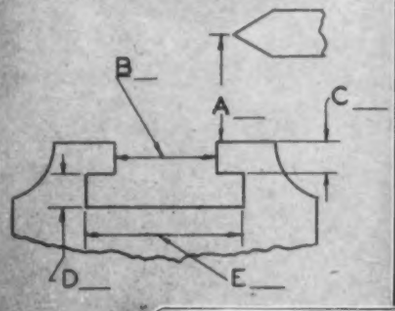

After Cut No. 9


After Cut No. 10

INFORMATION REQUIRED TO FILL ORDER

Base to mount thread tool is machined to fit lathe tool slide and give proper height to cutter. Therefore the five dimensions, marked A-B-C-D-E, on diagram must be given.

A separate cutter is required for each pitch and form of thread. Therefore the form and pitch of each cutter must be given.

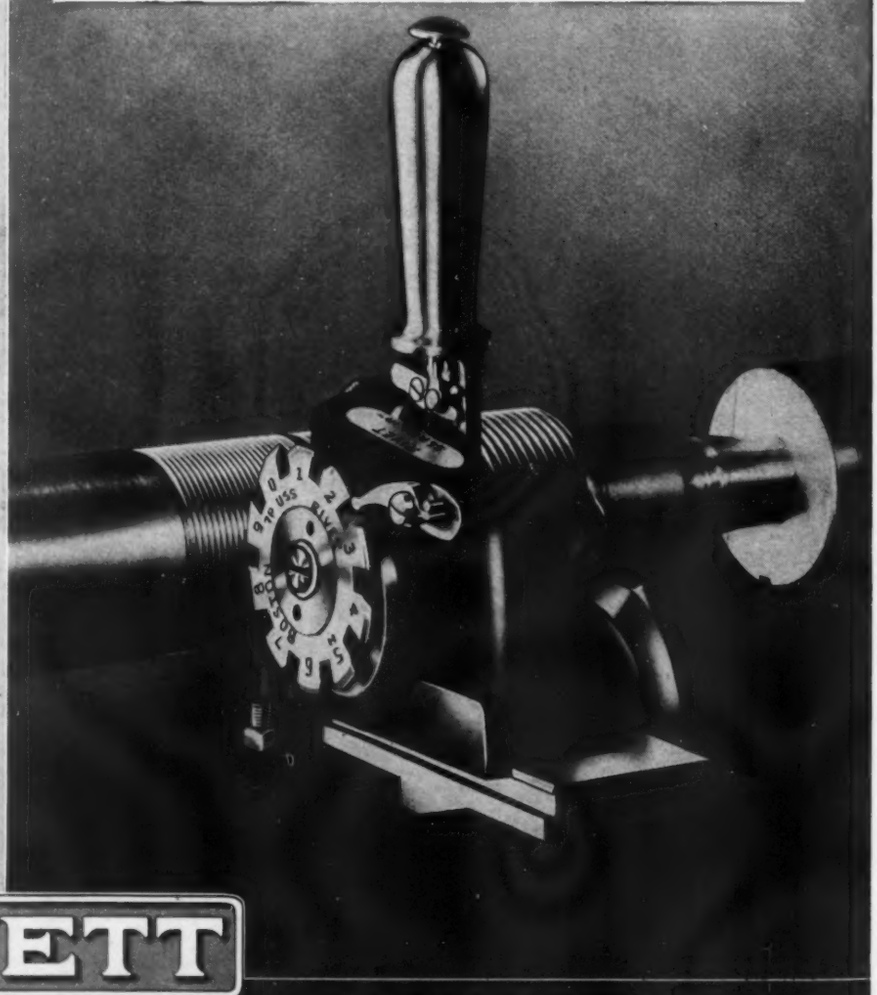


THREAD TOOL AND CUTTER

USED ON ANY SCREW-CUTTING LATHE FOR PRODUCING PERFECT THREADS

The Rivett Thread Tool mounts on lathe tool slide and takes the place of single point thread tools and chasers. The tool is a holder for a ten tooth cutter with means for indexing the cutter to present each of the ten teeth successively to the work. The first nine teeth rough out the thread in nine heavy, measured cuts, the tenth tooth finishes the thread. The ground cutter controls the perfect form and lead of the thread. The responsibility of the operator is reduced to indexing the cutter when reversing the lathe. A cutter can be furnished for threads up to 4" diameter in any form and in pitches of six threads per inch and finer.

Write for Bulletin 110



RIVETT

RIVETT LATHE & GRINDER, Inc.

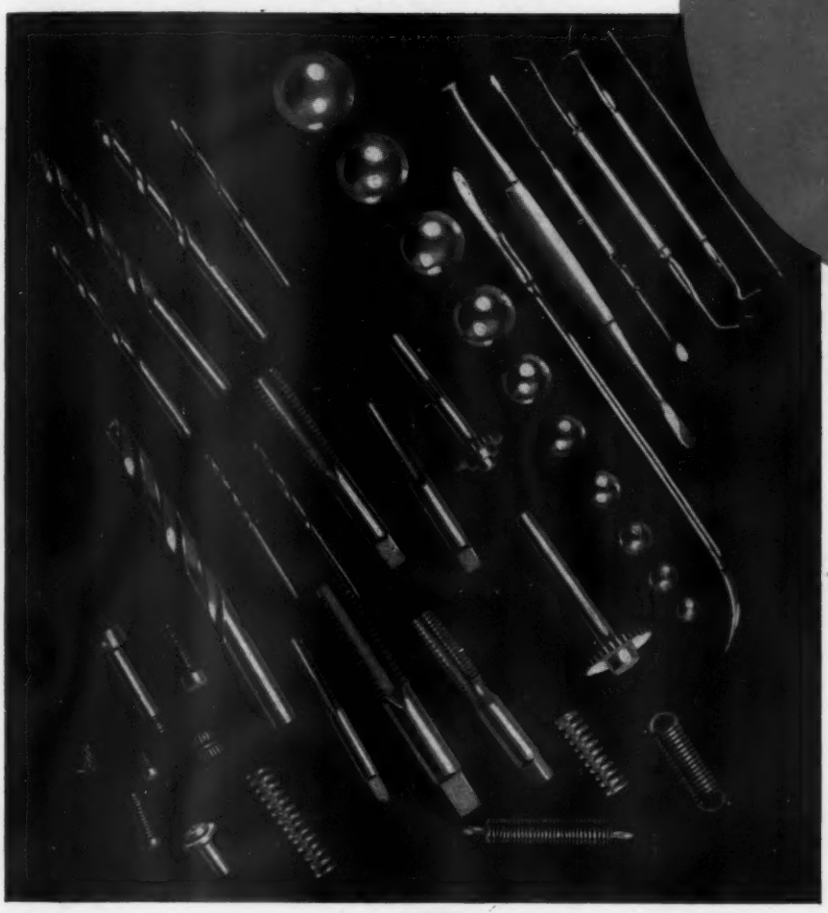
BRIGHTON • BOSTON • MASS. • U. S. A.

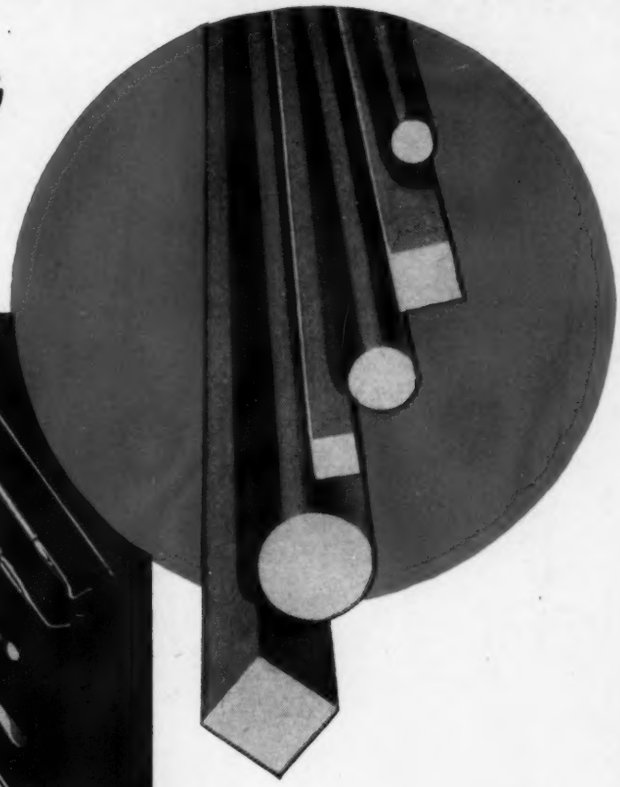
GLOBE DRILL ROD

a

FIRTH STERLING

Product





Available in High-Speed Steels, Tool Steels, Stainless Steels—in Bar, Rod and Wire. It is supplied in various finishes—polished, ground, and rough drawn or rough ground. "A Uniformity of High Quality."

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NEW KRW HYDRAULIC PRESS BOOK of PROFITABLE PRODUCTION IDEAS

NOW AVAILABLE AS HAND-OPERATED ELECTRIC-OPERATED AIR-OPERATED *Presses...*

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11

• ACME ALUMINUM ALLOY CASTINGS

*TRIPLE-A Almag 55 provides the extra strength and elongation required for this aluminum part.
Announcing
TRIPLE
ALMAG 55

A *LIGHT* METAL IN WEIGHT . . . A *HEAVY* METAL IN STRENGTH

HERE is a new aluminum castings alloy with a tensile strength of 50,000 to 60,000 pounds per square inch. It is far stronger than gray iron—approximates the strength of malleable iron. And it has a remarkable elongation of 15% to 30%. Called *TRIPLE-A Almag 55, and produced by Acme alone, this new alloy is truly a heavy metal in strength. Yet, it has the light weight of an aluminum magnesium alloy.

No matter what metal you now use, ask about Acme Aluminum Castings made of Almag 55. This new alloy may bring to *your* product the light weight—the corrosion resistance—the free machining—and the silver-bright surface that only aluminum gives.

Remember, too, there are no finer castings— sand or permanent mold—than those coming from Acme's big, modern, light-flooded foundry. There the most advanced castings techniques are backed by 25 solid years of foundry experience. For full information on how today's aluminum alloy castings made for today's demands may be applied to your product problems, get Acme's recommendations without obligation.

*Trade Mark and Patents Pending.

ACME ALUMINUM ALLOYS, INC.

DAYTON 3, OHIO

Patterns · Tools · Aluminum, Brass, Bronze Castings · Engineering

New York: F. G. Diffin Co., 111 Broadway
Chicago: Metal Parts & Equipment Co., 2400 W. Madison Street, St. Louis: Metal Parts & Equipment Co., 3615 Olive St.

a "TOOL BOX" *in the palm of your hand*

HOLLOW HANDLES HOLD INTERCHANGEABLE UNITS

The Hallowell speed tool kits were designed to simplify and improve the equipment necessary to those who use a variety of bits or wrenches. They have swivel bit-chucks for better leverage and for reaching difficult places. The tools contained in the Socket Screw Kits and Socket Wrench Kits (they each come in two sizes), were carefully selected to give the most convenience to their users. Tool bits are made of the finest *alloy steel;* the handles of famous durable *Celanese* plastic.*

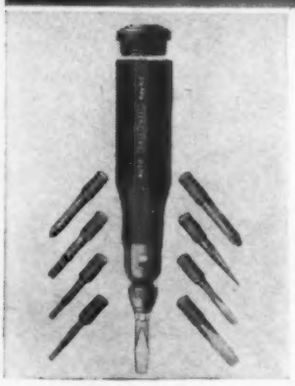
Socket Screw Kit #25, with swivel head drive, contains 8 tools: 6 hex bits: 1/16", 5/64", 3/32", 1/8", 5/32", 3/16"; # 1 Phillips; 1 flat screw driver bit.

Socket Screw Kit #50, with swivel head drive, contains 9 tools: 6 hex bits: 1/8", 5/32", 3/16", 7/32", 1/4", 5/16"; #2 and #3 Phillips; 1 flat screw driver bit.

Socket Wrench Kit #75 contains: 5 (12 point hexagon) sockets with openings: 1/4", 5/16", 11/32", 3/8" and 7/16". *With ¼" square drive.*

Socket Wrench Kit #100 contains: 6 (12 point hexagon) sockets with openings: 3/8", 7/16", 1/2", 9/16", 5/8", 3/4". *With ⅜" square drive.*

Obtainable at Suppliers throughout the country. If your supplier does not carry these kits, send his name to us, along with yours, and you will be taken care of promptly.



AUTO KIT

Auto Kits (in two sizes) . . . contain small tools most necessary for auto maintenance. Phillips Bits, Clutch Head Bits, Flat Screw Drivers and Tapered Reamer.

HOME KIT

Home Kit . . . contains flat screw drivers (1/16" and ¼" wide), Phillips screw driver, square tapered reamer, gimlet, tack puller and bottle cap opener.

See our exhibit in Booths 326-328, at the A.S.T.E. New Era Exposition in Cleveland, April 8-12.

ARMY E NAVY

*Reg. U.S. Pat. Off.

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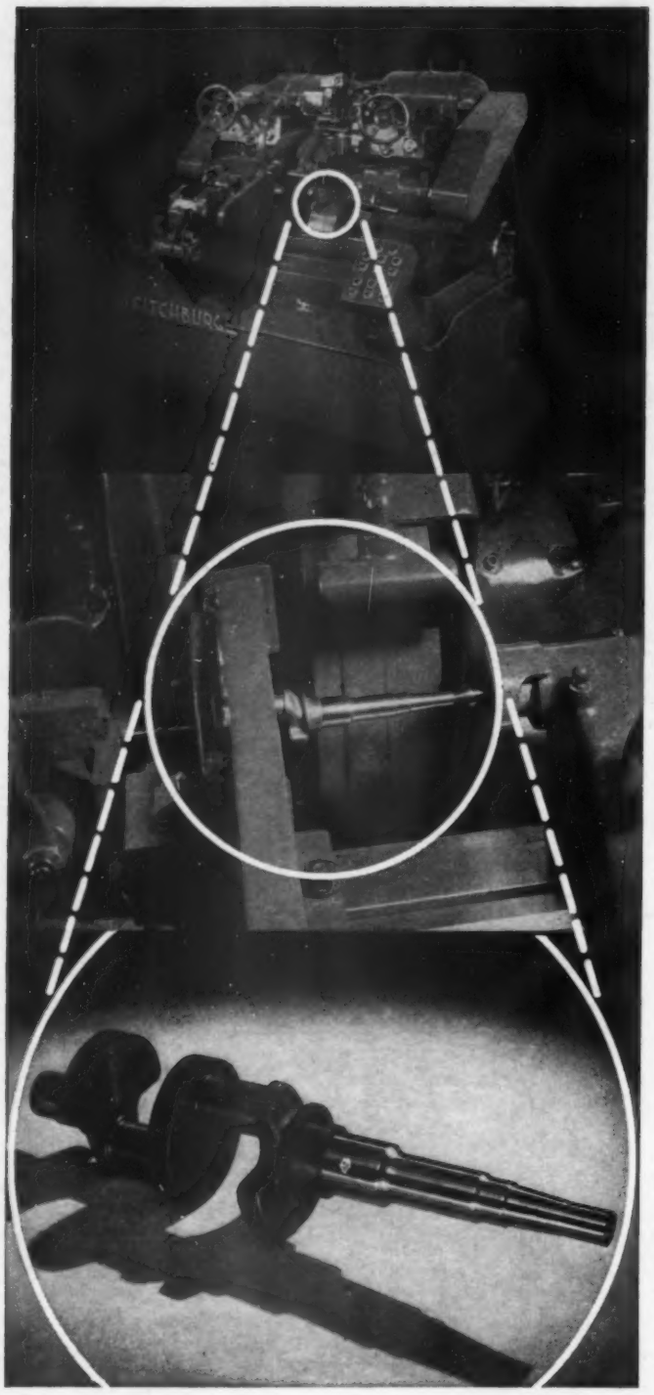
STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 4 BRANCHES: BOSTON · CHICAGO · DETROIT · INDIANAPOLIS · ST. LOUIS · SAN FRANCISCO



PRECISION

Grinds 6 Central Diameters at one time!

In this latest example of Fitchburg's specialization in multiple-precision grinding for mass production, two standard automatic-cycle Fitchburg Bowgage Wheelheads are mounted on a special base. A center drive attachment is used.

One form-dressed wheel grinds *five diameters* in a single plunge-cut while the other wheel grinds the sixth diameter.

The operation of the machine is very simple. It consists of loading the work and pressing the start button. The Bowgage Wheelheads go through their automatic cycle simultaneously: rapid traverse to the work . . . proper grinding feed . . . spark out . . . and rapid return—and *all six* diameters are precision-ground with *fine finish* at one time.

All six diameters are ground *within* the time it would ordinarily take to grind *one*. In addition to saving the time required for the five other operations, all the dimensions are accurately controlled in correct relation to each other—thereby greatly reducing the chance for work spoilage.

Fitchburg automatic, multiple-precision, mass-production grinding equipment is saving hours and dollars in many large and small industrial plants.

Call on the specialized experience of Fitchburg's grinding engineers. They can show you how to dig hidden profits out of your grinding operations. There is no obligation.

Send for new fully illustrated book—write for it on your business letterhead—it will be mailed free.

FITCHBURG GRINDING MACHINE CORP.
FITCHBURG, MASSACHUSETTS, U. S. A.
Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Both Full Universal Grinders and Special Purpose Grinders

DEALERS SAY,

"It's certain to sell"

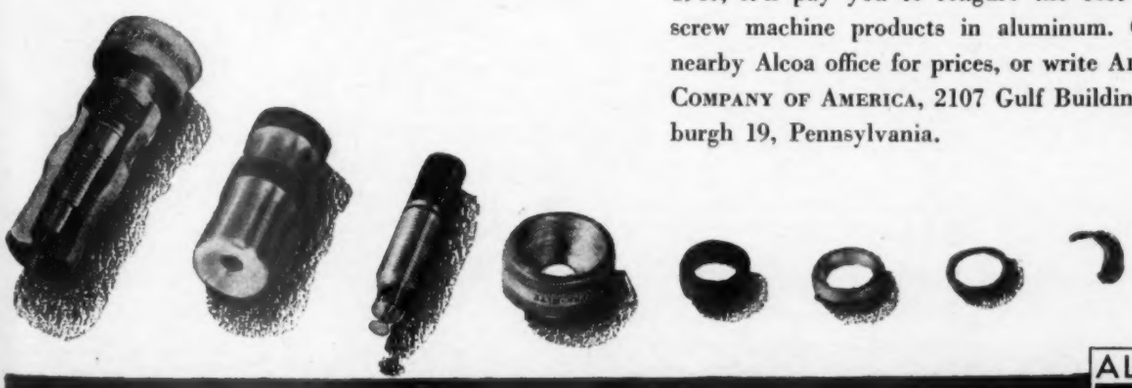
It's made of Alcoa Aluminum Screw Machine Stock

Put this nozzle on a hardware counter and it's bound to catch the shopper's eye. Thus, Alcoa Aluminum helps make another sale.

The manufacturer tells us that his costs, using Alcoa Aluminum Screw Machine Stock, are comparable to the costs of materials he has used before. So he gets a bonus in the form of a better looking, faster selling product.

Alcoa Aluminum Screw Machine Stock machines at high speeds. With it costing less today than in 1940, it'll pay you to refigure the cost of your screw machine products in aluminum. Call the nearby Alcoa office for prices, or write ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh 19, Pennsylvania.

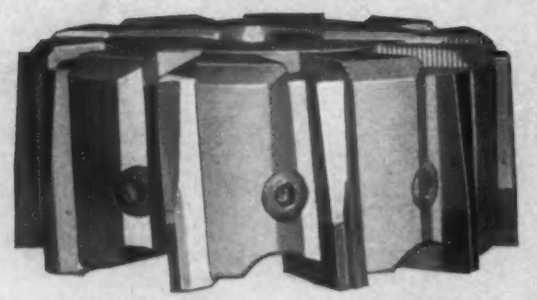
Stile-Craft Manufacturers of St. Louis make this good-looking garden hose nozzle, using 7/8", 1" and 1-5/16" 17ST Alcoa Aluminum Screw Machine Stock.

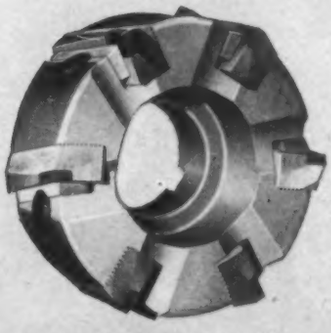


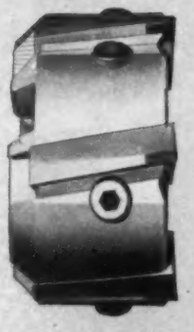
ALCOA FIRST IN **ALUMINUM**

ALCOA ALUMINUM

INGERSOLL CARBIDE CUTTERS *for Steel*







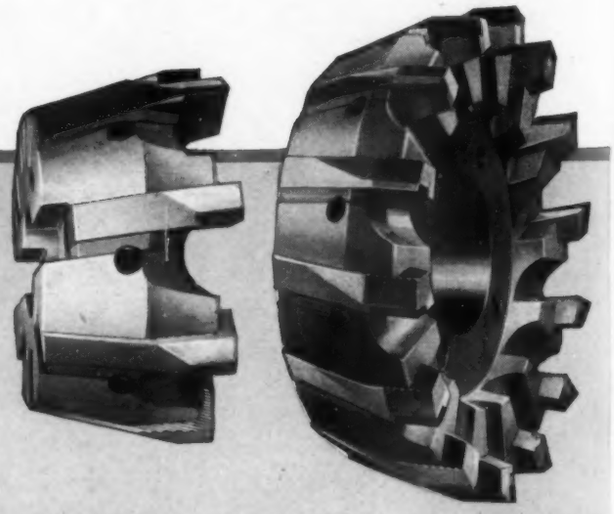
MEDIUM DUTY 3/16" STOCK

Cutter No.	Diameter	Teeth	Price
98104X	4	6	$ 46.00
98106X	6	8	52.00
98108X	8	12	70.00
98110X	10	14	95.00
98112X	12	16	115.00

Ingersoll offers many other designs of *inserted blade* milling and boring tools with carbide tipped, cast alloy, and high speed steel blades — Face mills, end mills, slotting cutters, helical slabbing mills, cylinder boring and combination boring, facing and chamfering tools.

The introduction of *negative cutting angles* has made possible the use of carbide tipped blades for milling steel. Under proper operating conditions these cutters will greatly increase feed rates and improve finish and tool life.

Both medium and heavy duty series available with *inserted replaceable* carbide blades for lowest operating cost. You purchase one cutter housing for each application. You fill and refill this housing many times with *inserted blades* at fraction of replacement cost of new solid type cutters.



HEAVY DUTY 1/2" STOCK

Cutter No.	Diameter	Teeth	Price
94108XX	8	8	$ 90.00
94110XX	10	10	125.00
94112XX	12	12	150.00
94114XX	14	14	175.00

Write for catalog giving complete details on inserted blade milling and boring tools.

THE INGERSOLL MILLING MACHINE CO., ROCKFORD, ILLINOIS

THERE'S NO "CORKSCREWS" IN THAT PILE

NO! NOT WITH SPEED CASE x1515

A LOW CARBON OPEN HEARTH PRODUCT

—and when Speed Case is carburized and hardened, long shafts show a very minimum of distortion and—no "Corkscrews" result. This result is consistently attained even when getting 60 to 64 Rc. hardness on the Case and strong tough core. *Speed Case* machines from 40% to 60% FASTER than all other carburizing steels. There is no other steel like SPEED CASE!

Write for our Brochure which gives complete data and Case Histories furnished by our customers

Tear this off . . . ATTACH TO YOUR LETTERHEAD AND MAIL TO EITHER COMPANY BELOW

ACTUAL PHOTOGRAPH

Speed Case (.20 carbon) 1 inch cold drawn bar tied in a knot, without fracture.

Licensor

MONARCH STEEL COMPANY

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PECKOVER'S LTD Toronto, Canadian Distributor

MANUFACTURERS OF A COMPLETE LINE OF COLD FINISHED CARBON AND ALLOY STEEL BARS

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THE FITZSIMONS COMPANY

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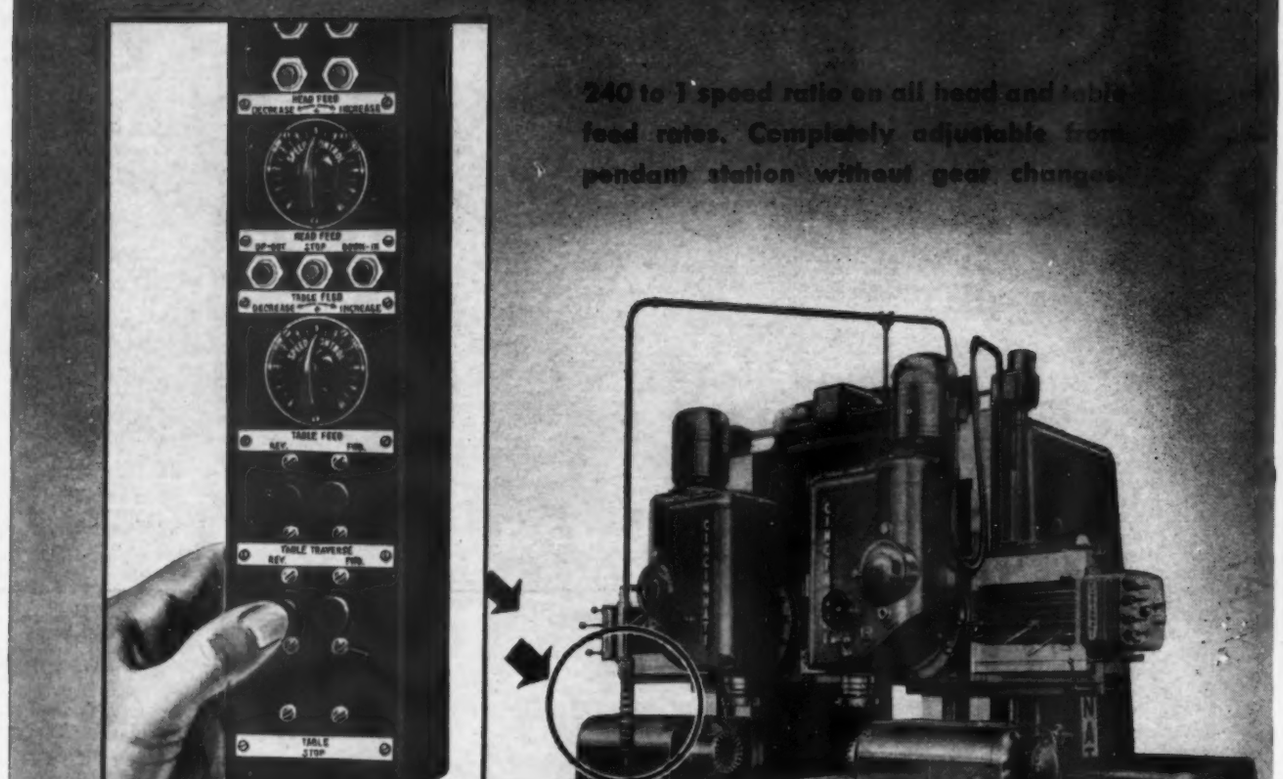
240 to 1 SPEED RATIO...

Hypro-electronic

PLANER MILLER DRIVE

240 to 1 speed ratio on all head and table feed rates. Completely adjustable from pendant station without gear changes.

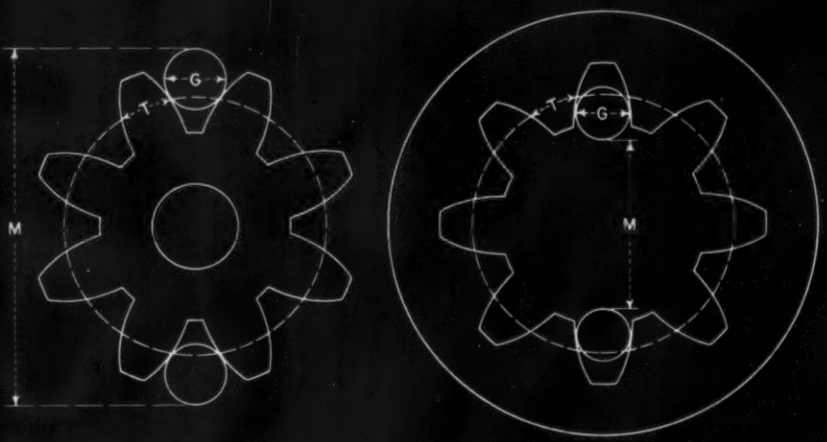


THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO

Van Keuren



EXTERNAL SPUR GEAR **INTERNAL SPUR GEAR**

ULTIMATE ACCURACY

Catalog No. 33 is a manual of precision measuring systems, giving complete tables and simplified formulas for measuring standard and special threads, splines, gears and worms. Send for Catalog 33 and Circular G 37.

SIMPLE! . . . . The only calculation required is one of simple division.

RELIABLE! . . . . The system is favored by outstanding American Gear Manufacturers.

ACCURATE! . . . . The Van Keuren 1.68" Gear Tables (Cir. G 37) are complete for gears from 5 to 500 teeth and for pressure angles of 14½°, 17½°, 20°, 25° and 30°. If the measurement over the wires is greater than the value calculated from the tables, the tooth is too thick and cutter must be fed further into the gear blank. Exact constants for controlling tooth thickness and backlash to .0001" are given for all pressure angles.

MEMBER OF AGMA

Van Keuren

27th YEAR

EVERY DEMAND FOR SAVINGS IS BEING MET . . .

. . . in "The Tools You Buy Again"

Small tools — at the business ends of machines working to capacity — must be capable of making time, labor and material savings in order that production demands be met. UNION TOOLS are meeting such demands in the countless plants turning out war materiel. They are saving time by faster cutting — saving labor by requiring less resharpening — conserving material by assuring accuracy and minimizing spoilage.

The ability of UNION TOOLS to make savings is traceable to an in-built fineness of quality which in turn is the result of UNION'S long, specialized experience in small tool development.

For the sake of savings, it will pay you to standardize on UNION.

Twist Drills — Milling Cutters — Reamers — Hobs — Slitting Saws — End Mills — Taps — Dies — Screw Plates — Profile Cutters.

•

UNION
TWIST DRILL COMPANY
Athol, Mass.

STORES New York Store: 61 Reade St.; Los Angeles Store: 524 East Fourth St.; Chicago Store: 11 So. Clinton St.; Seattle Store: 568 First Ave., So.; San Francisco Store: 121 Second St.; Detroit Store: 5527 Woodward Ave.

MANUFACTURING DIVISIONS
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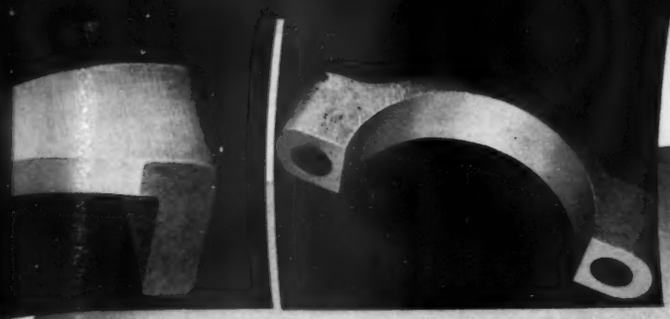
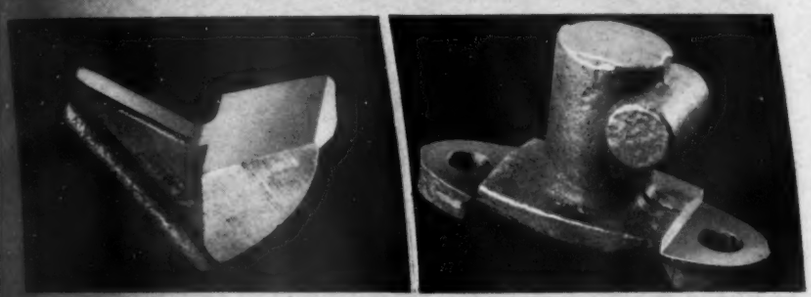
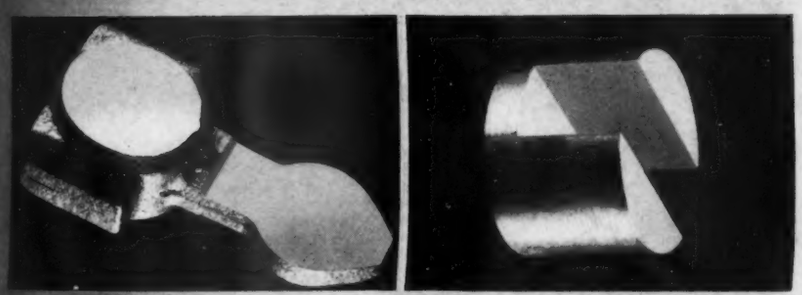
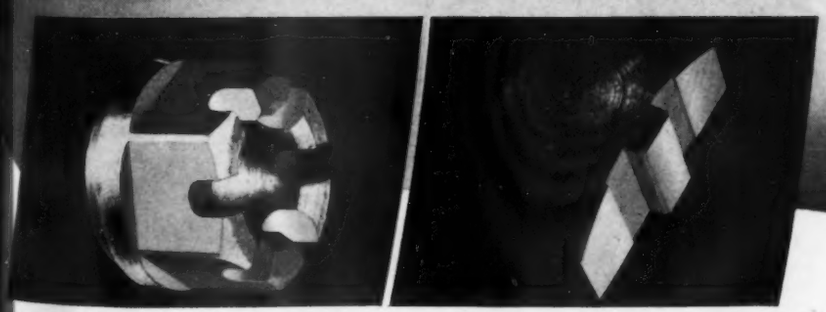
UNION



Higher Production in Machining *Irregular Surfaces*







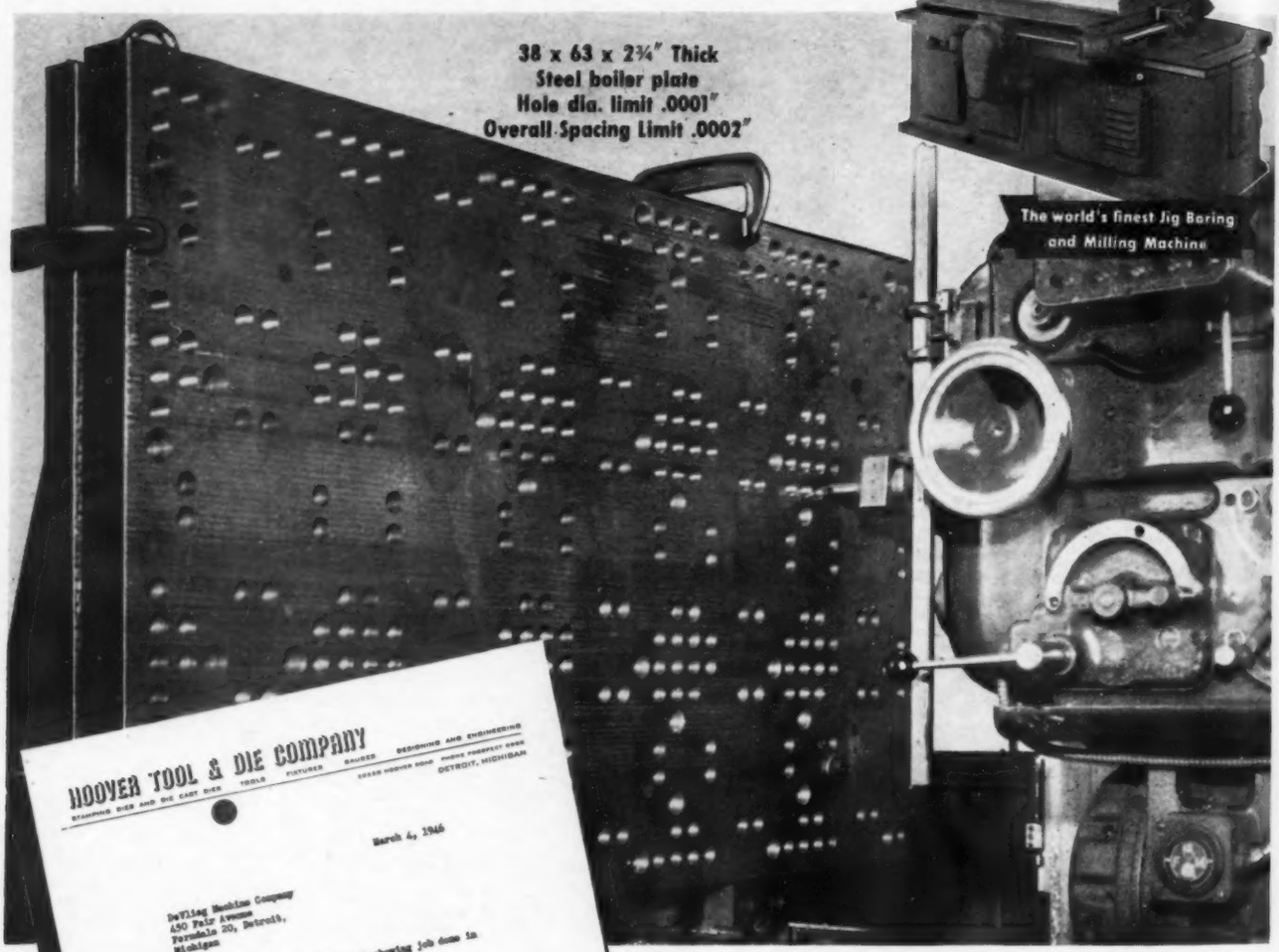
IRREGULARLY shaped parts having curved, slotted, beveled or serrated surfaces may be broached on Footburt machines at high production rates. Surface broaching is now being used in many plants to produce work similar to these illustrations, with higher production per machine and lower tool maintenance cost than was possible with former machining methods. We will be glad to work with you on the possibility of applying surface broaching to your work. Just send blueprints of your parts with information on number of pieces per hour required.

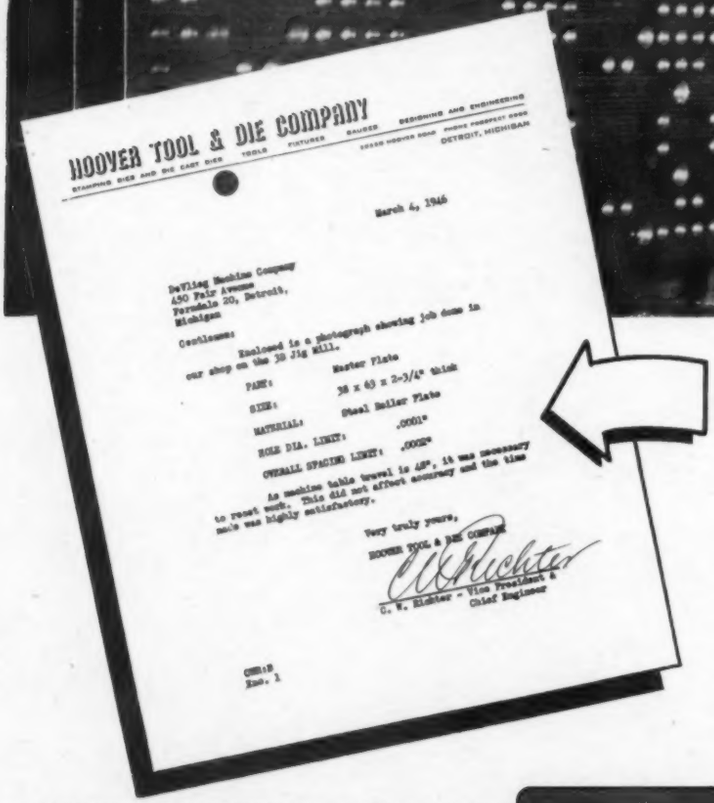
THE FOOTE-BURT COMPANY
Cleveland 8, Ohio
Detroit Office: General Motors Building

Footburt Patented Tooth Form

FOOTBURT *Surface Broaching*

342 holes held to .0002" limit with JIGMIL automatic positioning


38 x 63 x 2¾" Thick
Steel boiler plate
Hole dia. limit .0001"
Overall Spacing Limit .0002"
The world's finest Jig Boring and Milling Machine



HOOVER TOOL & DIE COMPANY

STAMPING DIES AND DIE CAST DIES · TOOLS · FIXTURES · GAUGES · DESIGNING AND ENGINEERING

DETROIT, MICHIGAN

March 4, 1946

DeVlieg Machine Company
450 Fair Avenue
Ferndale 20, Detroit,
Michigan

Gentlemen:

Enclosed is a photograph showing job done in our shop on the 3B Jig mill.

PART: Master Plate
SIZE: 38 x 63 x 2-3/4" thick
MATERIAL: Steel Boiler Plate
HOLE DIA. LIMIT: .0001"
OVERALL SPACING LIMIT: .0002"

As machine table travel is 48", it was necessary to reset work. This did not affect accuracy and the time made was highly satisfactory.

Very truly yours,
HOOVER TOOL & DIE COMPANY
C. W. Richter
C. W. Richter - Vice President & Chief Engineer

CWR:D
Enc. 1

Here are the results obtained by one user of 3-B DeVlieg JIGMILS on a difficult boring operation. The JIGMIL will also cut costs in your plant because:

(1) Only one set-up required for both boring and milling operations.

(2) Centralized Push Button Control Panel and Slide Lock Levers operated through finger-tip pressure.

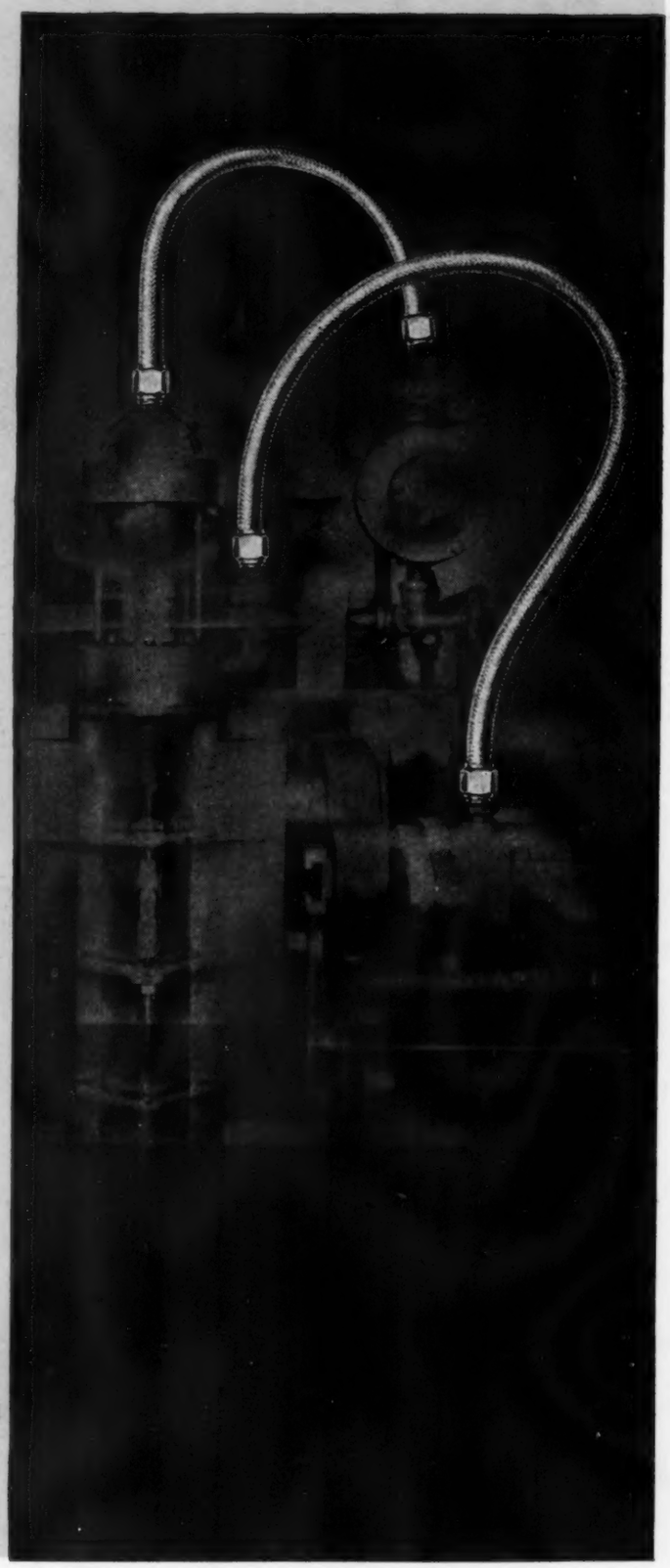
(3) Automatic spacing to within .0001" of setting permits unvarying accuracy on jigs, fixtures and duplicate parts.

Technical literature available upon request. Write today.

DeVLIEG MACHINE COMPANY DEVLIEG JIGMIL **450 FAIR AVE. FERNDALE 20, (Detroit) MICH.**

PRESSURE-TIGHT PERFORMANCE FOR YEARS...

at 475 Oscillations per Minute!



You're looking at Titeflex all-metal, flexible tubing serving a double purpose. First, as a hydraulic oil line supplying up to 75 pounds p.s.i. Second, as the exhaust return line.

Primary reason for the use of Titeflex in this out-of-the-ordinary installation is that its inherent pressure tightness—despite constant oscillation—prevents the line leakage that would mean impaired operating efficiency...work spoilage.

Titeflex likewise provides identical trouble-free protection and service while operating under constant vibration, pressure, heat, cold, or corrosive attack.

If you are not already aware of the economies and increased service performance that stem from Titeflex installations, our application engineers will gladly give you the facts. Titeflex, Inc., 535 Frelinghuysen Avenue, Newark 5, New Jersey.

Titeflex

THE ALL-METAL FLEXIBLE TUBING
THAT STAYS TIGHT

ENGINEERED FOR ACCURACY

14-1/2" x 5' South Bend Quick Change Gear Lathe. Price, less electrical equipment and chip pan, f. o. b. factory,
$1095.00

BROADEN THE SCOPE OF YOUR LATHES

South Bend Attachments and Accessories simplify and speed tooling, often save delay and expense of making special fixtures. Shown above is the Handlever Draw-in Collet Attachment. Write for illustrated Catalog No. 77 which shows all South Bend Attachments and Accessories.

South Bend Lathes are engineered to meet exacting needs for precision accuracy in all types of industries, and to maintain their accuracy year after year, even under strenuous production conditions. Accuracy and long life are built into South Bend Lathes as carefully and surely as they are built into fine timepieces. Correct design based on nearly forty years of research and experience, quality materials specially selected for specific needs, expert craftsmanship, strict inspection through all phases of production and assembly, and thorough testing to rigid working tolerances before shipment, guarantee dependable performance in laboratory, toolroom, production shop, and maintenance department.

South Bend Engine Lathes and Toolroom Lathes are made with 9", 10", 13", 14½", and 16" swings, and bed lengths to 12'. Turret Lathes are made with collet capacities to 1". Write today for free 68-page catalog which illustrates all sizes and models, gives detailed specifications, and shows all attachments and accessories. Ask for Catalog 100-D.

SOUTH BEND LATHE WORKS

419 EAST MADISON STREET • • SOUTH BEND 22, INDIANA

LATHE BUILDERS SINCE 1906

4 FUNDAMENTALS

GIVE THESE CUTTERS THEIR SUPERIORITY

1 CORRECT DESIGN
2 SELECTED MATERIALS
3 ACCURATE MANUFACTURE
4 SCIENTIFIC HEAT TREATMENT

Use Brown & Sharpe Cutters to Maintain Your Production Schedule

STYLES AND SIZES FOR MOST REQUIREMENTS

Catalog on Request

B·S BROWN & SHARPE MFG. CO.
Providence 1, R. I., U. S. A.

. . . We urge buying through the Distributor

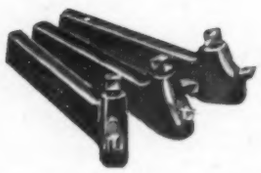
BROWN & SHARPE CUTTERS

ARMSTRONG

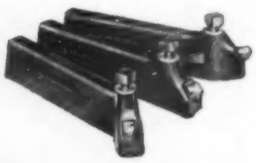
SYSTEM OF TOOL HOLDERS

What speed do you need? 100, 300 or 600 ft. p.m.

Whatever cutting speed is required, whatever the material to be machined, there are correctly designed ARMSTRONG TOOL HOLDERS with bits, blades and cutters of the most efficient cutting material provided by the Armstrong System of Tool Holders.



ARMSTONG TURNING TOOLS for ARMSTRONG HIGH SPEED or other high speed steel cutter-bits



ARMSTRONG CA TOOL HOLDERS for ARMALLOY and similar cast-alloy cutter-bits

ARMSTRONG Carbide TOOL HOLDERS for ARMIDE and similar carbide-tipped cutters

Included are: ARMSTRONG TOOL HOLDERS AND CUTTERS	*Recommended Cutter Speed*
ARMSTRONG Turning Tools for ARMSTRONG HIGH SPEED Cutter Bits	50-150 ft. p.m.
ARMSTRONG CA Tool Holders for ARMALLOY and similar cast alloy cutters	100-350 ft. p.m.
ARMSTRONG Carbide Tool Holders for ARMIDE and similar carbide-tipped cutters	300-600 ft. p.m.

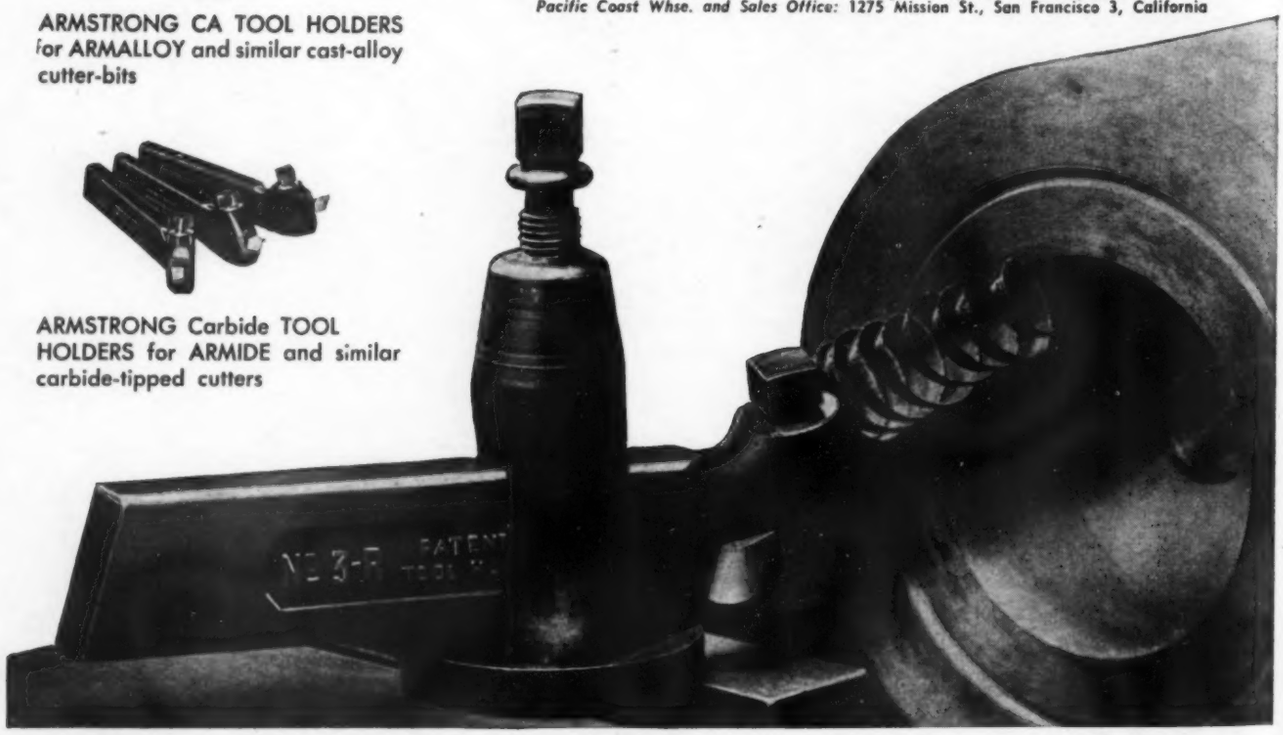
Write for new Circulars "Armide" and "Armalloy" circulars.

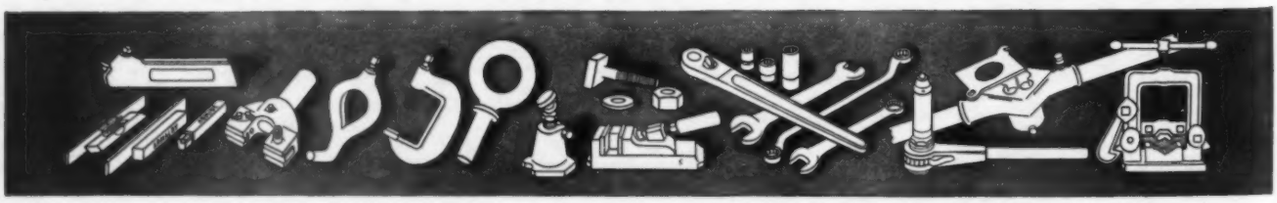
ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

315 N. FRANCISCO AVE. **CHICAGO 12, U.S.A.**

Eastern Whse. and Sales: 199 Lafayette St., New York 12, N. Y.
Pacific Coast Whse. and Sales Office: 1275 Mission St., San Francisco 3, California





MORE ACCURACY AND FASTER TAPPING

This head will help you increase production. It cuts class three threads, or better, on long production runs.

Consider these exclusive features:

1. One head for rotating or stationary spindle machines—just remove handle and apply cover plate. Cuts down tool investment.

2. Simple construction—few parts—broad bearing surfaces—hardened and ground throughout—for longer life.

3. Blade-type ground thread chasers on sizes 1¼" to 4". Circular ground thread chasers on sizes 3" to 5".

4. Quick trigger-action collapsing. Easy diametric adjustment without removing head from holder.

Quicker—more productive—easier to operate—higher precision—smaller tool investment—longer life. Ask for Catalog D42 C.

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

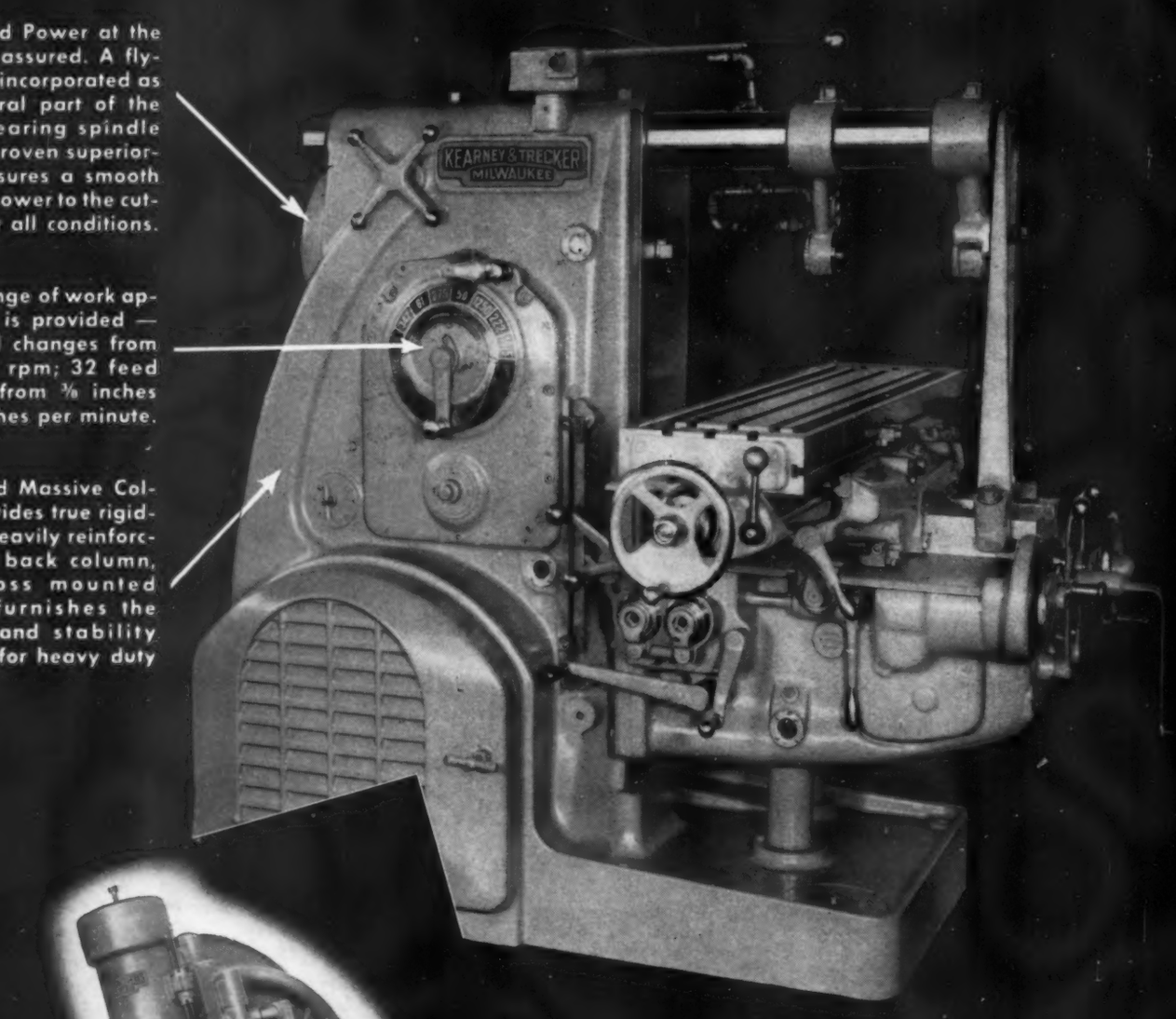
ANNOUNCING

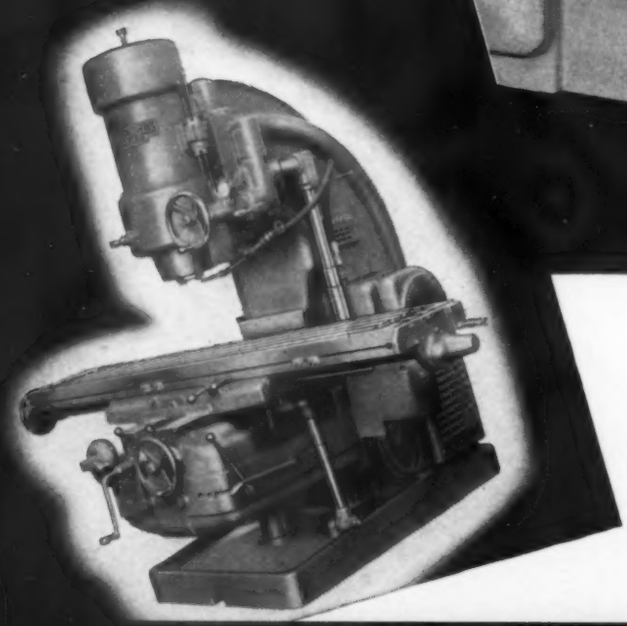
An outstanding addition to the

Balanced Power at the cutter is assured. A flywheel is incorporated as an integral part of the center bearing spindle with its proven superiority. It assures a smooth flow of power to the cutter under all conditions.

Wide Range of work application is provided — 16 speed changes from 50-1250 rpm; 32 feed changes from ⅜ inches to 90 inches per minute.

A Rugged Massive Column provides true rigidity. The heavily reinforced solid back column, with cross mounted motor, furnishes the strength and stability required for heavy duty service.





30 HP CSM HORIZONTAL knee-type machine illustrated abov shows the modern, compact design, rugged construction and co veniently accessible controls. Rugged and versatile — all models i the CSM series are designed to meet the stringent requirements o the high rate of metal removal possible when using carbide cutter

50 HP VERTICAL MODEL of the CSM Series shows outstandin efficiency and versatility of Kearney & Trecker design. Note th rugged column, the built-in flywheel, the accessible controls — a suring utmost productivity and accuracy on all jobs.

THE CSM'S . . .

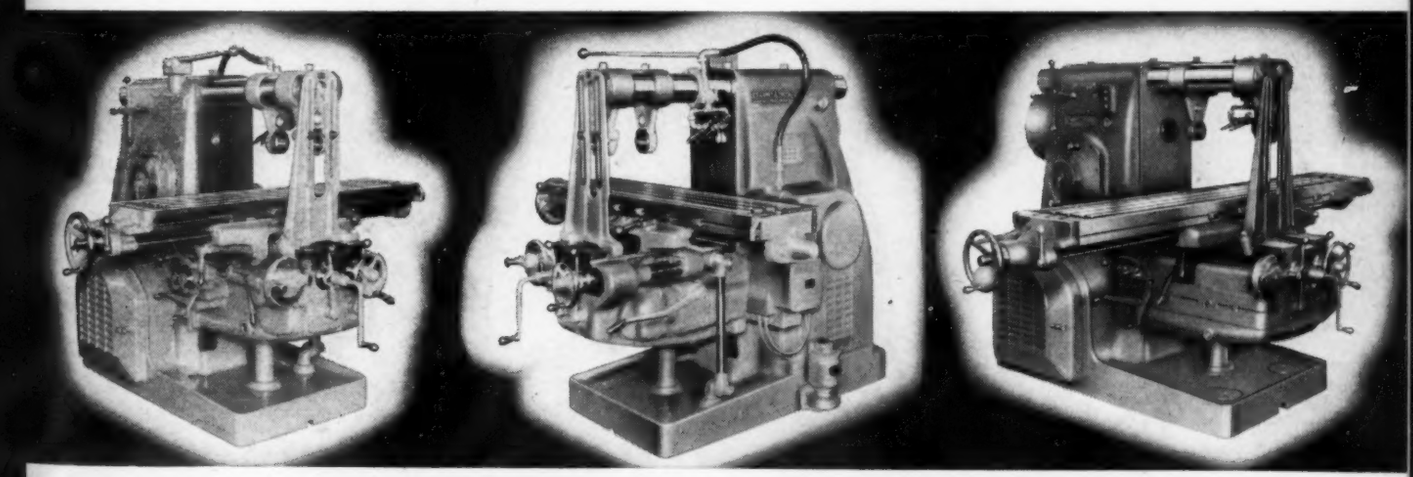
Kearney & Trecker Milwaukee Line!

New Series of CSM Knee-Type Milling Machines Now Cuts Production Hours to Minutes Over a Wide Range of Jobs!

A complete series of CSM Machines, high powered for carbide milling of steel — machines that will handle regular milling jobs as well — this is Kearney & Trecker's latest contribution to modern milling equipment.

Pioneered and developed by Kearney & Trecker research engineers, the CSM machines embody the newest and finest in design and engineering features to meet the requirements of modern carbide milling of steel: 1) Solid-back column gives powerful support and rigidity to entire machine; 2) a large, heavy flywheel is an integral part of the spindle, and assures smooth, balanced flow of power to cutter from 20, 30, or 50 hp motor; 3) Wide range of speeds and feeds are carefully selected to match work requirements.

Time-tested operating and performance features of the famous Kearney & Trecker "K" Machines have also been included to give you the finest in up-to-date milling machine construction and operation. CSM Machines are available in both horizontal and vertical knee-type models. For complete information, write for descriptive catalog.



A complete series of power rated machines, in horizontal and vertical models, to meet your requirements.

20 CSM Horizontal—a 20 hp machine with 28" or 34" table travel.

30 CSM Horizontal—a 30 hp machine with 34" or 42" table travel.

50 CSM Horizontal—a 50 hp machine with 42" or 52" table travel.

Write today for Complete Information on these New Machines

KEARNEY & TRECKER CORPORATION

MILWAUKEE 14, WISCONSIN

This 12,500% increase *sounds fantastic!*

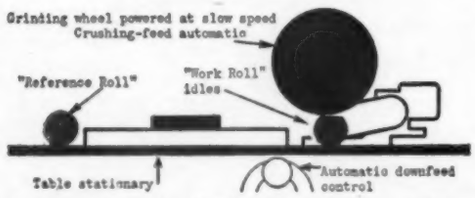
But True! One of the major drawbacks to crush form grinding precision flat form contours has been the inability to produce on a practical production basis. This obstacle has been eliminated in two ways by the new Thompson Truforming Process.

First: Truform Grinders are engineered and built as a single unit, eliminating the failures of make-shift crushing arrangements and attachments.

Second: TWO CRUSHING ROLLS ARE USED. This is a major advancement, because it greatly extends crushing roll life and makes possible, for the first time, quantity production without constantly disturbing the set-up to re-process the crushing roll.

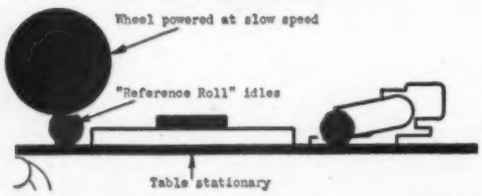
How two rolls operate in the Truforming Process is briefly illustrated and described below. The normal crushing or truing position is shown first.

Normal Crushing Position
Also Truing or Dressing



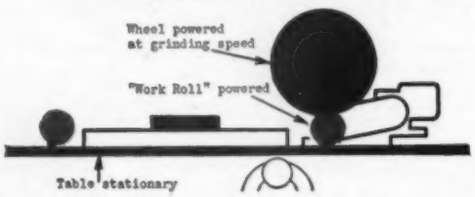
This is the position for the initial crushing of the wheel—and for subsequent truing or dressings when production grinding. On an eight pitch modified buttress thread form, 125 dressings were provided by the "work roll" before losing form.

Touching-up Position



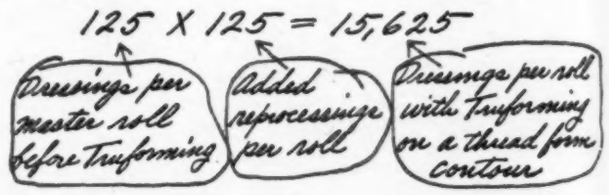
When the "work roll" loses form the table is moved to bring the grinding wheel over the "reference roll" for touching up, as shown above.

Re-processing Position



Because both rolls are table mounted, are in perfect alignment, and can be brought in the same relation to the grinding wheel, the original degree of accuracy can be quickly transferred from the "reference roll" back into the grinding wheel . . . and then ground back into the "work roll" as shown above.

The machine is then ready for production grinding again without disturbing the set-up or removing anything from the machine. In this way the "work roll" can be re-processed whenever it loses form and can be used for hundreds of additional dressings, or until it is worn out. Duplicate crushing rolls can be ground in the same way on all Thompson Truform Grinders.


125 X 125 = 15,625
Dressings per master roll before Truforming
Added reprocessings per roll
Dressings per roll with Truforming on a thread form contour

What this means in savings is illustrated by the following example, involving a modified buttress thread form with an eight pitch form. Where two rolls are used in the Thompson Truform Process, it was possible to get *over 15,625 dressings* from the "work roll" before it was worn out. This meant an increase in continuous production (without changing or disturbing set-up) of 12,500%.

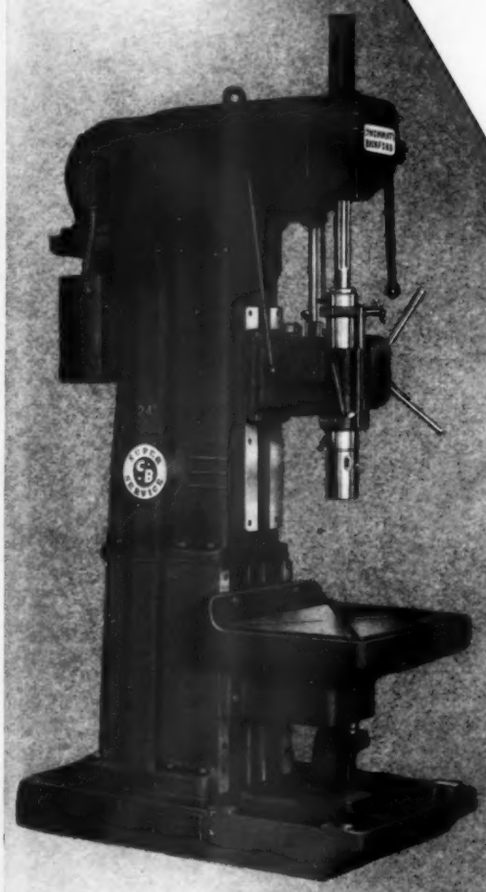
Write for the new 8-page Truform Leaflet—"Why didn't you tell me about this process before?"

Address Dept. 16

The Thompson Grinder Company • Springfield, Ohio

FOR HIGH PRODUCTION INDUSTRIES . . .

New METAL DRILLING MACHINES



These Super Service Upright Drills meet the fundamental requirements of high production. They are speedy, safe, simple, and rugged. You get more holes per dollar. Easy, accessible controls, sizes and capacities to your need—to your profit.

Write for booklet U-27 on complete new line of Cincinnati Bickford Super Service Direct Drive Upright Drills.

See our condensed catalog in Sweet's File.

A KEY TO MORE HOLES PER DOLLAR

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

Equal Efficiency of Every Unit
Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

Now...

Portable Bryant Thread Gages

Bryant Thread Gages have proved their superiority for bench work . . . now, the new *Portable* gage offers fast, accurate inspection of internal threads in large castings, work in the machine, etc., or in any parts where bench inspection may be inconvenient.

The Bryant Portable Thread Gage is so accurate that it can be used to check master gages, and on production work it will check threads *all over* in a few seconds. It is 4 to 5 times faster than plug gaging. Retracting gage segments *eliminate* threading the gage into and out of threaded holes — they prevent wear — on Class 4 and 5 fits, selective assembly is possible by classing threads according to indicator readings — pilots on back of thread segments mean rapid, catchless insertion and removal of the gage — there is no chance of cross threading.

The fastest, cheapest, most accurate method of inspecting threads is the Bryant method — it is the *only* method for *visually* indicating the size of internal threads. Write for complete details.

Perfect for inspecting threads on large pieces that cannot be moved conveniently to the inspection department.

Allows checking of threads in the work in the machine.

Eliminates threading of gage into and out of threaded holes.

Four or five times faster than plug gaging.

Gives overall inspection in a few seconds—at a glance.

Master gage accuracy transferred quickly to production parts.

BRYANT

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

American Machinist's Spot NEWS OF METALWORKING

Removal of all price controls on capital goods, including machine tools, is likely within the next few weeks. OPA will reinstate ceilings if prices go up too much. Decontrol will replace earlier plan to raise ceilings 10%-15%.

Army Air Corps will retain Dodge-Chicago aircraft engine plant as standby factory. Containing 62,000 machine tools, it is being frozen "as is."

Soviet Russia has refused to accept escalator clauses in orders for American machinery recently placed. Officials take the position that the government must buy for a firm price and not make commitments involving more money later on.

Six big tooling programs are "hot" in the automotive industry. General Motors is asking for rush delivery of machine tools held up by its strike, but some builders are refusing to make shipments until they can machine test parts in their own plants.

> **One of nation's leading economists says: strikes have not dissipated our purchasing power appreciably. People have not got started on spending yet and current savings are still abnormally high. If productivity continues to gain in next decade as it did after the First World War, our national income in 1960 will be well over $300,000,000,000.**

New type of spot-welding unit called the single-pole piston is used in making automobile bodies at the Gorki plant in Russia. The new unit welds parts unreached by hydromatic welders.

Ninety percent of surplus machine tool demand today is for popular standard types—toolroom lathes, drilling machines, planers, universal millers—of which there is a shortage.

American railway suppliers are benefiting from Brazilian orders. Mogyana Railway has bought 375 miles of rails, 150 box cars, 12 MacArthur type locomotives and other equipment. Central of Brazil has contracted for locomotives and electrification material and for 72 electric cars with U.S. Electric Export Co.

Some 50 GI's have started building small car and farm trailers in Michigan alone, employing government funds to get going. Now they discover that they cannot buy axles, wheels and springs because price ceilings have compelled former producers of these items to turn to manufacture of other products.

Russia has been purchasing sizable quantities of machine tools in this country. Turkey and Finland also have been making cash deals for machine tools.

OPA story: A large metalworking plant recently idle because of a strike lost money at a rate of $30,000 while down. Operating full tilt the plant lost $60,000 as a result of price ceilings imposed by OPA.

Newly-formed Bobbi Car Corp. expects to produce daily 1500 of its rear-engine small cars, advance orders for which are expected to take a full year's output. It is seeking two San Diego plants from Consolidated Vultee, in addition to its present factories in San Diego suburbs.

Automobile works at Yaroslavl, Russia, is beginning production of five-ton trucks powered by diesel engines. At end of new Five-Year Plan, a truck will be built every 12 minutes.

Kaiser-Frazer plans to make 500 cars in May, 2500 in June, 8000 in July, 90,000 in fourth quarter, but it may not be able to achieve this schedule. Frazer will be first car produced. Bodies, made by Mullins, Budd and Hayes, will be assembled and trimmed at Willow Run. Most of the welding line has been completed.

Russia plans to have 1,300,000 machine tools installed in its factories by 1950. This compares with 1,700,000 in U.S. now.

30% INCREASE IN TOOL LIFE

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American Machinist

BURNHAM FINNEY, Editor

Tools for Schools

Never has the need for proper teaching equipment in our schools and colleges been so great as it is now.

Tens of thousands of veterans as well as 'teenage youngsters will be pouring into our engineering and vocational institutions during coming months.

If they are to benefit fully from their courses, they should be taught today's techniques, not yesterday's. And they must learn to apply these techniques on modern machine tools, not those decrepit with age or obsolete in type and design.

What an opportunity to put to work in the worthiest of causes a considerable number of the government's surplus machine tools built in the last few years!

Sounds fine, doesn't it? But our government itself says, "No, it can't be done. It's a splendid idea, a high-minded cause, but there is no way in which to do it under present laws. Sorry."

The fact that present laws do not permit it should not stop us. Actually, there is a way in which it can be done. A simple amendment to the present Surplus Property Act will do it.

That amendment will make it possible for accredited educational institutions not operated for profit to acquire surplus machines by paying only the cost of crating and shipping them from their present location to the designated school.

Though too few people know about it, this suggested procedure is not new. It has been tried successfully on a small scale by the Army Service Commands. They have permitted schools and colleges to secure from them on this basis a number of surplus machine tools before the Service Commands have declared them surplus to the War Assets Administration.

But the total thus acquired are as nothing compared with the number that educational institutions could use to good advantage if they were made available at no cost except crating and shipping.

In the case of one machine tool builder alone, 128 schools have asked for more than 1,000 of his machines which are in the government surplus classification. This is typical of the latent demand for good, modern surplus machines on the part of schools and colleges.

It is roughly estimated that school shops could use 50,000 to 100,000 of the more than 600,000 surplus machine tools if offered at crating and shipping expense only.

Surely that is better than to let many of these machines be charged off eventually as a total loss. Some of them have been idle in warehouses or in outdoor storage for a year or more. In fact, many machines exposed to the elements will be worthless unless quick action is taken.

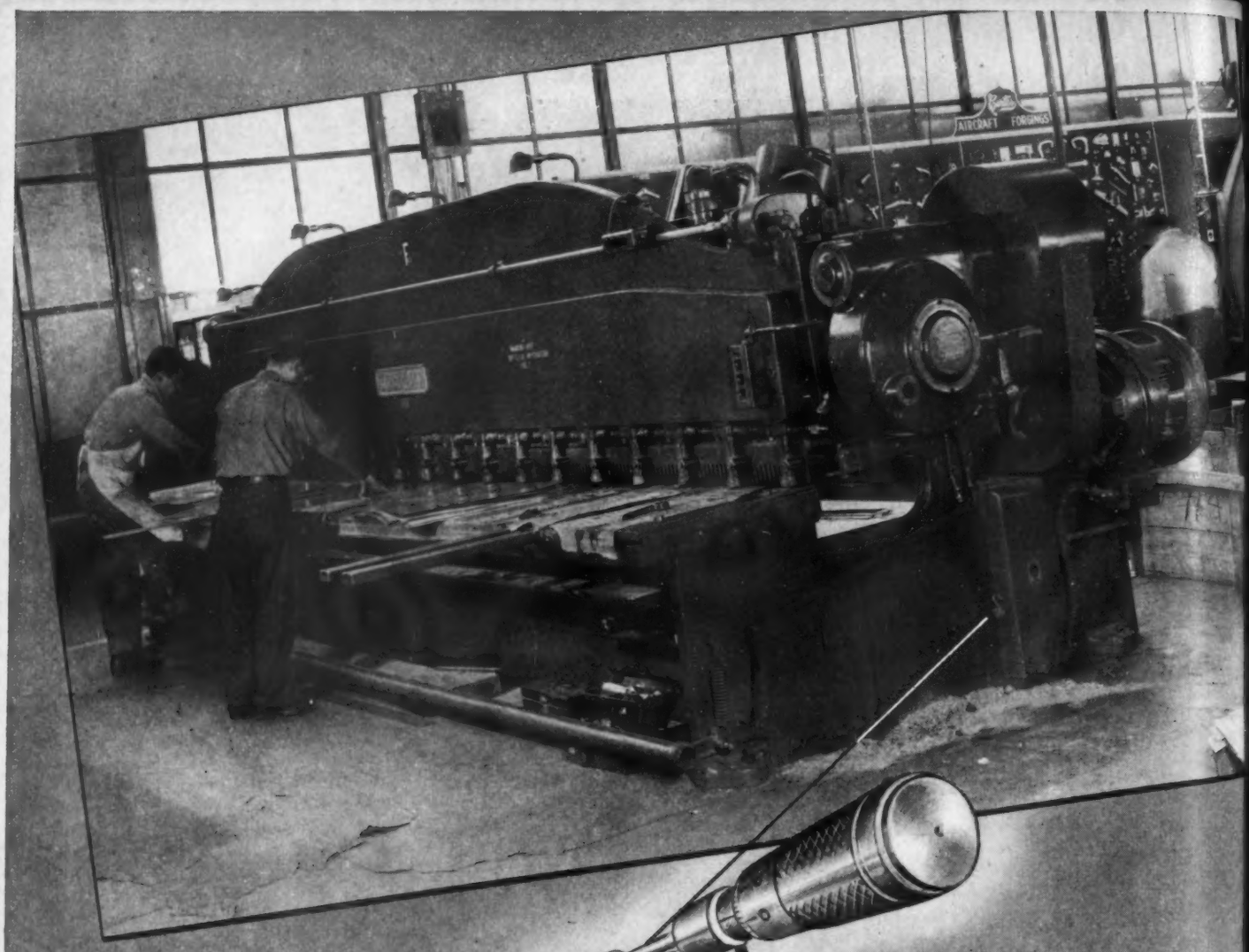
Schools cannot afford to buy surplus machines at present government prices, even after the 40% discount from the Clayton formula is allowed. They can afford, on the other hand, to pay the crating and shipping charges to obtain them.

The Army Service Commands no longer have machine tools available on a crating-and-shipping-charge basis. The Army, Navy and other federal agencies refuse to adopt this practice. The War Assets Administration has ruled that the Surplus Property Act specifically forbids it to give surplus machines under its control to educational institutions.

Hence the necessity for amending the Surplus Property Act at once. House Bill HR-5517 provides for such an amendment. A similar bill is before the U. S. Senate. Both bills should be passed promptly. We urge you to write your Congressman asking him to vote for this bill.

Let's make it possible for our schools and colleges to modernize their shops quickly and thus keep pace with industry's new techniques.

Burnham Finney



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How to Estimate Manufacturing Costs In a Small or Job Shop

BY DAVID P. OBERG

SUPERVISOR OF PLANNING, SAN FRANCISCO MACHINE SHOP, AMERICAN CAN COMPANY

WHAT WILL IT COST? This is one of the first questions raised by the consumer before making a purchase. As sales price is dependent upon the manufacturer's cost, the survival of many an organization will depend on this vital question, especially in view of the troubled labor picture, with its increased demands on one hand and stabilized prices on the other. Wartime "know how" will add to increased manufacturing efficiency and offset these to a degree, but how much? Adding to the complexity of this question is the fact that this country will emerge into an era of competition so keen that only the fittest will remain in business; a far cry from the shadows of the past five years, with their "Production at any price."

Leaving the factor of unsettled wages and controlled prices out of the picture, a manufacturer's view into this critical problem is more or less of the importance with which the manufacturer views it; this, no doubt, sounds like an ambiguous statement, but in reading on one can see its justification.

On what basis are costs determined? Are they estimated from a set of *basic factors* or "guesstimated" with but one thought in mind, a "desirable figure" without regard to all of the factors involved?

Much of the uncertainty of estimating is a result of the lack of appreciation of what is involved in producing estimates of accurate and constant validity. Therefore, before setting up a yardstick for determining the validity of estimates, let us start at the beginning:

In one organization, a cost clerk is the estimator; in another a semi-skilled technician, in another a shop foreman; while in still another, a skilled production man, one who has the pulse of current conditions in his grasp at all times, is responsible for the estimates.

The cost clerk or semi-skilled technician can handle the job as well as the production man when costs are worked up from standard costs on repetitive jobs performed over a period of time and by taking the factor of prevailing conditions into account, together with the variables of estimating. The shop foreman is likely to figure from the shop point of view only; thus allowing too large a margin for safety. This would put the estimate too far above its competitors.

When a yardstick for determining the validity of estimates is set up, on what percentage of estimated jobs do the estimated costs and the final costs compare favorably and within what percentage? An estimator should work to a set of standard variables when figuring jobs say of $1,000 and under, $1,000 to $5,000, $5,000 to $15,000, $15,000 to $50,000, $50,000 to $150,000 etc. The above grouping would be set, of course, to suit the products and sizes of jobs contemplated. The estimator, taking into consideration these points as well as those outlined further on in this article, should then be able to estimate within 10% on the favorable side 90% of the time. To start with, is the job under consideration a company's own product or is it a product contracted from another source? War production has made strange bedfellows of a number of companies. Concerns manufacturing articles for years have found that other companies in lines foreign to theirs were able to manufacture their product cheaper than they could themselves. Should the job or parts of it be contracted,

Operators of limited-production machine shops, and veterans who plan to enter metalworking, have asked for practical costing data. Mr. Oberg gives a summary based on his experience, plus a chart

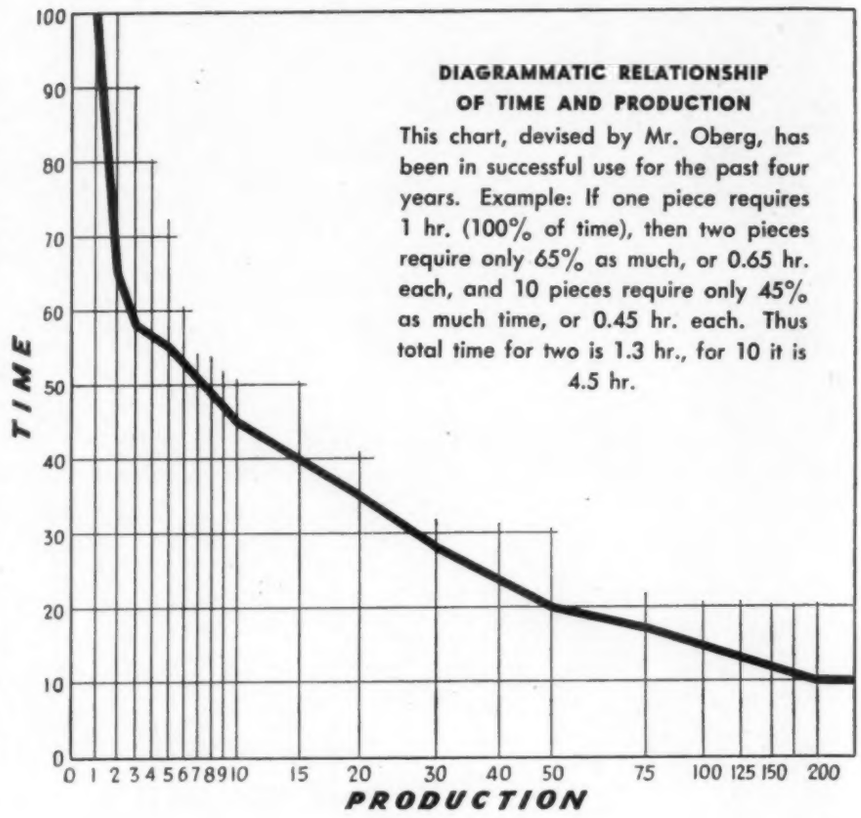
this would set up other variables to be considered.

When the job is placed in the proper category, there is then the type of estimate to be considered. (1) cost, (2) firm price, and (3) ceiling price. Of course, the cost estimate, covering labor, burden and material, is the basis for the other two types. The safety margin allowed over the cost estimate would be the determining factor in reaching the other two types of estimates. The basis for all estimates, as well as their outcome, depends upon these three items, labor, burden and material. Thus, upon examining each one carefully together with the technical aspects of estimating, the estimator has the basic variables he must work with at all times. This leaves out all of the rule-of-thumb estimating, which is often the practice of a number of estimators. Estimating in this fashion usually means looking a drawing over for so much lathe, mill, drill, and grind work; then doubling the original figure and adding 50% or any other unstable and inconsistent means of arriving at final costs.

LABOR—Producers: At what percentage would you rate their efficiency—50, 60, 70 or 85? This is an important item, as this percentage is one of the important variables of estimating. Should the occasion arise requiring the employment of additional help, these percentages will be subject to change. How much and over what period of time would all departments be rated on the same efficiency basis? This is important on specialized jobs. For example, a job having lathe and grinding operations only would probably rate differently than one having lathe, mill, drill, heat-treating and grinding operations included.

Non-Producers: The efficiency of the producers is in a large degree dependent upon that of the non-producers. Good supervision and able leadership on the part of management is as vital a factor in determining costs as is the machine operator who produces a quantity of parts in a day.

BURDEN—Is it a variable, if so to what extent and at what periods? Does it move in cycles? Is it, or any part of it, controllable to a degree that might be considered a constant? Is the operating organization performing at peak efficiency, and if not, when and where do variations occur? Money saved in direct manufacturing operations can be lost through inefficient office and shop management.



DIAGRAMMATIC RELATIONSHIP OF TIME AND PRODUCTION

This chart, devised by Mr. Oberg, has been in successful use for the past four years. Example: If one piece requires 1 hr. (100% of time), then two pieces require only 65% as much, or 0.65 hr. each, and 10 pieces require only 45% as much time, or 0.45 hr. each. Thus total time for two is 1.3 hr., for 10 it is 4.5 hr.

MATERIAL — Material costs are usually considered a stable factor, more or less. A company manufacturing a line of products over a period of time is able to work this cost down as well as its unit cost to a point where it can be computed on a poundage or percentage basis. A machine of new design, weighing say 3,000 lb. can be figured at 15, 25 or 40 cents a pound for material, or the material cost can be adjudged at 10, 20 or 25% of the total machine cost. The figure would vary with the production quantity under consideration. When building one 3,000-lb. machine of cast iron and low-alloy steels together with the commercial parts, bearings, oil seals, motor, etc., the material costs would probably run from 10 to 15% of the total cost of construction; when building the same machine in quantities of 50, the unit material cost would run from 15 to 25% of the total construction cost. This is an important factor to consider when using the illustrated production chart of "diagrammatic relationship of time and production." Through smart purchasing and a wide range of suppliers, material costs can be lowered substantially.

Once the three basic factors of estimating costs, labor, burden, and material are entered it would be well to cover the other variable factors of estimating. The order in which they are listed would vary in importance with different companies:

PRODUCTION—What is the difference in the cost of building ten machines over that of one machine? 75 machines over that of 10 machines? The chart gives the answer quickly and accurately. Certain rules *must* be observed in using this chart in order to obtain accurate results. This chart was plotted from the individual labor costs of hundreds of parts manufactured in the quantities listed. Assembly time and material costs are *not* considered; however, when it is desired to get a rough picture of over-all cost differences in varied manufacturing quantities on an assembled unit at a glance, the differences as listed are accurate enough when the desired production figure is obtained, then increased 50% to cover assembly and material costs.

When a chart of this nature is plotted there are several angles to machine-shop production and costs to consider; the basis, of course, being time versus production. Time and production elements were taken from hundreds of past records on numerous items. By breaking these items down into classifications, then averaging them out to give the graph curve, we found:

(1) Intricate machine and die parts involving considerable machine work and based on a wide variety of designs and materials. Some parts were fully tooled, others partially tooled, while others were untooled.

(2) Machine and die parts involving an average amount of machine work, some parts being fully tooled, others partially tooled, while others were untooled.

(3) Machine parts of a simple nature, having only two or three operations.

It was surprising how accurately these figures averaged out over the hundreds of items figured.

When this chart is used in estimating singular items, for example a shop bidding on a job of 50 parts, the first step would be to estimate carefully on the basis of setup time, etc., the labor involved when manufacturing *only one part.* Entering the chart under production at 50 and reading up would give the pro-rated time to manufacture one part when produced in quantities of 50.

Should the production quantity change at a later date, it is a simple matter to get the adjusted labor factor.

HOW TO USE THE CHART ACCURATELY

If it is desired to get the cost of a machine manufactured in quantities of 20, the first step would be to estimate the cost of one machine, thus:

1,000 hr. machine work (cost of individual parts)

Using the figure of $3 an hr...	$3,000
300 hr. assembly at $3 an hr...	900
Cost of materials.....	750
	$4,650

With the basic figure of $4,650 as the cost of one machine, it is now desired to get the cost of 20 machines. Looking at the chart under 20 at production, and reading up to the intersection of the curve which is 35, we find:

350 hr. machine work (cost of individual parts)

Using the figure of $3 an hr...	$1,050
200 hr. assembly at $3 an hr..	500
Cost of materials.....	675
	$2,225

If 20 machines are manufactured, their individual cost would be $2,225. This is a vast difference in cost, a flat 35% of $4,650, which would be $1,627. However, as mentioned before, increasing this figure 50% would give $2,437 as a rough estimate.

Figured on the basis of 20 machines, the reduction in assembly time and in material costs of one-third and 10% respectively are more or less a matter on which the estimator would have to decide from experience and from past cost records.

COST RECORDS—Over a period of time, the estimator should have built up a backlog of cost records. In this way, he is able to check his estimating for accuracy, and to build up a set of costs for future reference.

SPOT-CHECKING COSTS—It is a good idea for the estimator to make, or have made, periodic spot-cost checks as a job progresses, money spent as against job progress. This check shows up several things: possible production bottlenecks, departmental costs, job completion in regard to manufacturing schedules, and cost control within the estimate, engineering weaknesses in the form of stop works, altered drawings and parts reworked or scrapped and thus requiring additional expenditures.

SPOILAGE—Should records be available of a company's spoilage for over a period of time, they would be of considerable value to the estimator. Several things will be brought to light by such records; it will be found that during the summer months spoilage figures will probably climb, as a result of the shifting of personnel from machine to machine caused by vacationing employees. This period takes in the months of June, July, August and September. With the increased rate of spoilage, production will drop slightly. Spoilage figures stated in percentage will vary anywhere from ½ to 5% of the month's production.

TOOLING—The estimating of tooling (jigs, fixtures, and gages only) for a production job is of the utmost importance, yet probably the most difficult upon which to reach a satisfactory figure. There is the matter of amortization over a possible unknown quantity, probable engineering changes to obsolete or alter tools in progress. By increasing the tooling expenditure, would the additional production achieved be warranted? Should the job be only 25%, 50% or fully tooled from the start? When tooling a job the amount required for tool drawings will run anywhere from rough sketches made by the toolmaker to comprehensive drawings prepared by a tool designer at a cost up to or over 100% the cost of the tool itself. And, at that it would be cheap in terms of production. This is a matter of conjecture based on company policy, available personnel, etc.

PREVAILING CONDITIONS AND VARIABLES OF ESTIMATING — It has been found possible at one time to manufacture a product within the estimated figure while at another time the same job will run under or over the estimate by a considerable margin. To what is this variable attributed, and to what extent is it controllable?

If this question is broken down, a number of factors will be found involved. The importance of each factor would vary with the product under consideration and with the organization estimating the job. As a concluding thought, the estimator should keep these points in mind at all times:

(a) Hours of direct labor—All estimating records should be kept in direct labor hours, with material costs itemized; otherwise a true current cost picture is not available at a glance.

(b) Delivery schedules—When figuring price and production against completion dates, and when the time element is an important factor to consider in the estimate, careful attention should be given material delivery dates, necessity for overtime work, spoilage and possible engineering changes.

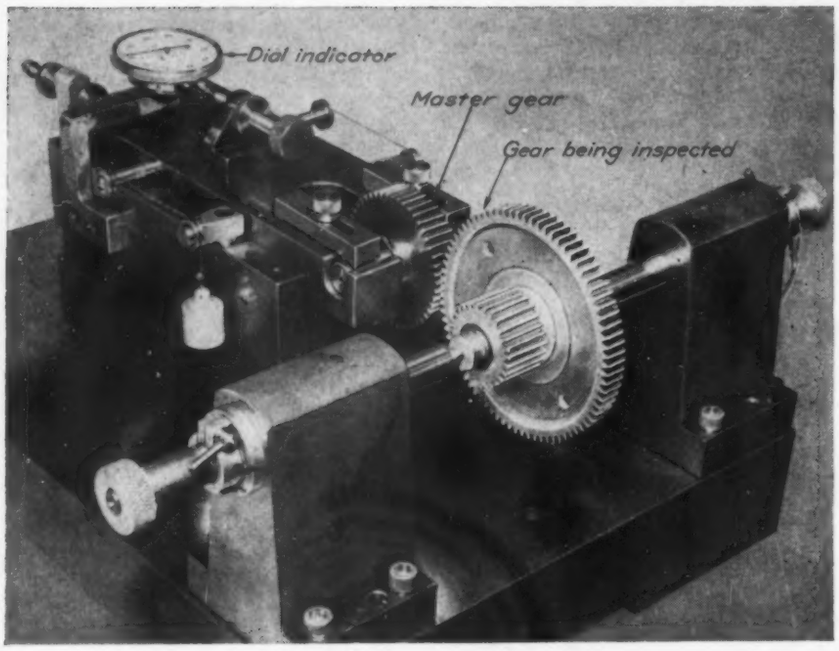
(c) Contracted work—Whether the job is to be contracted to or from another company raises several problems. There is the matter of manufacturing standards, fits, finishes and the acceptability of the product to both parties. Spoilage rates will probably be higher on contracted work over a company's own product, because of a complete lack of understanding of the job in question.

(d) Is the product of proved design? If not, there is the uncertainty of being able to follow a stabilized production program. Thus maximum manufacturing efficiency would not be undertaken as the added expense involved could not be realized under such circumstances. This would apply to labor, tooling and materials.

Thought for Today

"WORK a little harder,
SMILE a little oftener,
THINK a little straighter,
SERVE a little Better
CONSIDER the other fellow a little more frequently"

—*Santa Fe Railway Magazine*



Another gear inspection setup employs a dial indicator for visual readings of center-distance deviation

Gear Inspection Time Cut by Use of Masters

BY W. J. ADAMS, JR.

AERONAUTICS & MARINE ENGINEERING DIVISION, GENERAL ELECTRIC COMPANY

BEFORE THE NEEDS of World War II necessitated large quantities of precision gear-units for remotely controlled aircraft gun turrets, the engineering of such gear-units was somewhat incomplete.

The accuracies believed required at that time resulted in the loose term "zero backlash" gearing. Because of the impossibility of assigning tolerance for such a condition, no attempt was made to state drawing tolerances for the quality and size of gears, nor for the center distance between bores in the housings. Instead, reliance was placed upon the ability of "craftsmen" to sense that the gears they were making were good enough for the application, and later, by selective assembly and fitting them into a unit. The gears were generally made oversize for, with methods such as this, the natural philosophy was "better too big than too small."

Obviously, such methods were not adequate for quantity production. There were not enough craftsmen; there was not enough time. It was evident that control of quality had to be transferred from the craftsman to measuring devices. An investigation of available methods of checking gears disclosed a wide assortment of devices. There were pins for checking the size of gears, involute checkers for determining the accuracy of the profile, calipers for checking the tooth thickness. There was the block check and the cone-point check—each contributing its bit of information. But, invaluable as these methods are in determining what in particular is wrong with a gear, production required something much simpler and less laborious.

A study was made to consider the variable center distance method of checking gears with a master gear. However, while this method had been used to some extent, there appeared to be no established method of specifying tolerances for the essential properties of gears which could be simply interpreted, and of permiting ready inspection by other than skilled inspectors. To determine those properties of gears which are essential for proper performance, an extension of the variable center distance method was the first step taken to establish a new gear tolerance and inspection system.

Essential Properties of Gears

1. *Size* as it affects average backlash when meshed with another gear.
2. *Eccentricity* as it affects angular transmission, noise, torsional vibrations, tight spot in gears, etc.
3. *Tooth errors* as they affect involute action, noise, jumpiness, angular transmission, etc.

Determination of Gear Size

For a bench mark or a standard of *size* comparison, an assumed perfect master gear is selected. If this master gear is meshed with another perfect gear on spring loaded adjustable centers, as in Fig. 1, as the two gears rotate, there will be no change in the center distance. This is illustrated by line *A* of Fig. 2. In other words, if a dial indicator recording tester were calibrated for "zero" when the center distance is set for nominal, a zero indication will be given while the gears are rotated.

If, however, the gear were cut undersize so as to have 0.002-in. backlash when meshed with a master gear on nominal center distance, and assuming that in all other respects it were perfect, this gear, when meshed with a master gear on spring loaded centers, would rotate with an indication of approximately —0.003 in. for a 20-deg. gear as shown by line *B* of Fig 2. The minus sign denotes the gear is undersize and the 0.003 in. is derived from the approximate equation:

$$CD = \frac{B}{2 \tan \phi},$$

where *CD* is the change in center distance, *B* is the change in tangential backlash, and ϕ is the pressure angle. It can be seen, therefore, that the size of the gear can be specified by the deviation from "zero" or reference center distance as given by "max." and "min." indicator readings.

The maximum indicator reading multiplied by twice the tangent of the pressure angle represents the minimum backlash (max. size) the gear could exhibit when meshed with a master gear on the reference center distance.

The minimum indicator reading multiplied by twice the tangent of the pressure angles represents the maximum backlash (min. size) the gear could exhibit when meshed with a master gear on the reference center distance.

Gear Eccentricity or Runout

Assume a gear were perfect in all respects, except rotated on an axis which is 0.001 in. eccentric to the true center. If this gear were loaded in mesh with a master gear in the manner as described above, the center distance deviation from zero will be sinusoidal, as shown in Fig. 3.

Determination of Tooth Error

If the gear, in addition to being eccentric, has tooth errors, then the gear when run against a master will exhibit, super-imposed on the sinusoidal curve, an indication which is the frequency of the number of teeth in the gear as illustrated in fig. 4.

The difference in indicator readings between adjacent teeth is known as "Composite Tooth Error," since it results from the combined effect of involute, spacing, pressure angle, surface finish, etc., imperfections. The total difference in indicator reading in one complete revolution of the gear is known as the "Total Composite Error" since it results from the combined effect of tooth errors plus runout. It is possible to discriminate between total composite error and runout. However, it is unnecessary to do so, since for application purpose such as angular transmission, the total error must be reckoned with and not runout alone.

Tolerance Factors For Spur Gears

From the foregoing, the following four factors have been derived to control the quality of spur gears:

1. Maximum indicator reading.
2. Minimum indicator reading.
3. Composite tooth error.
4. Total composite error.

These factors are assigned tolerance limits on each gear drawing as illustrated later by Table II. They are inspected for in a one-setup operation by rotating the inspected gear against a master on a calibrated variable center distance fixture. This tolerance and inspection system has become known as the "Composite Gear Checking System."

To facilitate inspection and avoid mistakes, a "center distance radius" of the inspected gear is also given on the gear drawing. This value when added to the master gear center dis-

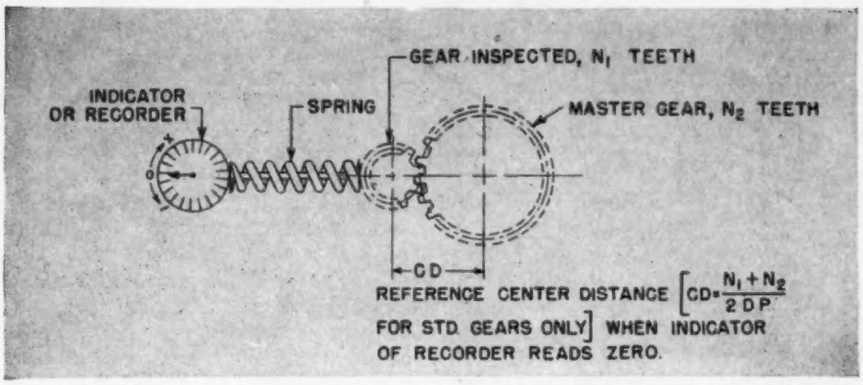


Fig. 1—There is no change in center distance if a master gear is rotated with another perfect gear on spring-load adjustable centers

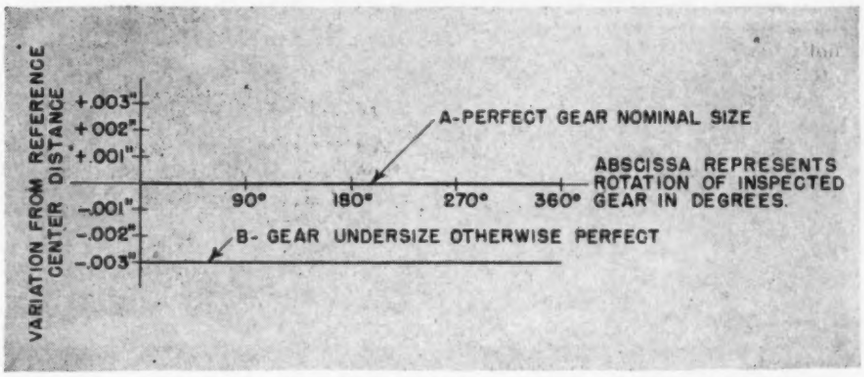


Fig. 2—An undersize gear (to allow backlash), otherwise perfect, would show a smaller center distance than standard but no variation while being rotated

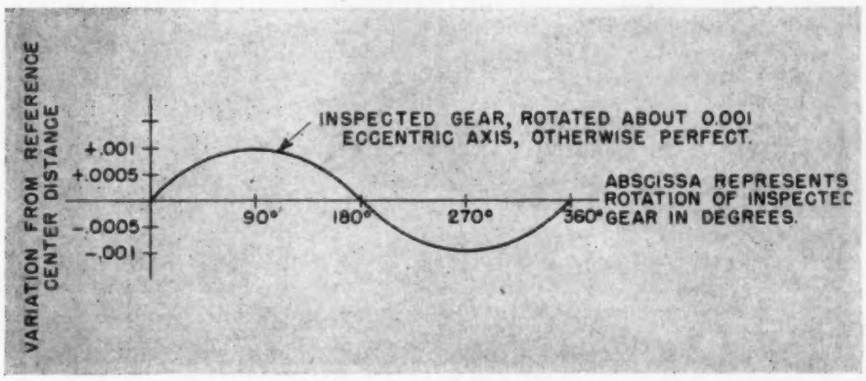


Fig. 3—A perfect gear run on an eccentric axis will show a smooth sinusoidal deviation, as indicated above

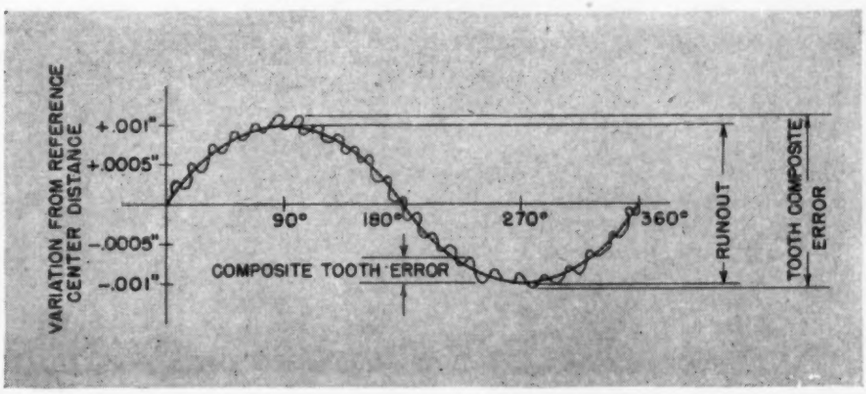


Fig. 4—An eccentric gear with tooth errors will show deviations, with a frequency of the number of teeth in the gear, on the sinusoidal curve

tance radius gives the total center distance for calibrating the master gear fixture for "zero" indication. Gage blocks are made use of to calibrate for "zero." If the gear center distance radius is larger than the theoretical pitch radius, $(\frac{N}{2DP})$, the gear is non-standard and of the long addendum type; and conversely, if the center distance radius is smaller, then the gear is of the short addendum type.

Composite Gear Checking System

In general, gears are used to perform primarily either of two functions: 1. Transmit power. 2. Transmit motion.

The importance of gear errors depends not only on these two functions, but also on the speed, the type of centers, whether fixed or adjustable, and the desired noise level. Table I will convey some idea of the relative importance and magnitude of the four tolerance factors for different gear applications.

It will be noted that the difference or band between max. and min. indicator readings is always larger than the total composite error, in order to allow for some size variation in the gear-cutting or shaving operations.

When the basic housing center distances are taken as nominal, the max. and min. indicator readings should generally be negative to make allowances for temperature differential expansion of the dissimilar materials, bearing eccentricities, and running clearance between the gears. If these allowances are not considered, then actual interference will result, unless the mating gear is made specially undersize or unless the housing center distance is made greater than nominal.

Practical Example

Assume the following design of a standard addendum gear for power transmission is desired:

20 deg. std. involute and addendum
30 teeth
16 diametral pitch
* Minimum backlash —0.002 in.
* Maximum backlash —0.006 in.
** Maximum total tooth error —0.004 in.
Runout or indicated eccentricity —0.0014 in.

The four factor tolerances and center distance radius are derived as follows. These are specified on the drawing along with the number of teeth, diametral pitch and pressure angle, etc., as shown in table II.

$$\text{Max. indicator reading} = \frac{-0.002}{2 \tan 20 \text{ deg}} = -0.003 \text{ approx.}$$

$$\text{Min. indicator reading} = \frac{-0.006}{2 \tan 20 \text{ deg.}} = 0.008 \text{ approx.}$$

$$\text{Composite tooth error} = \frac{0.0004}{2 \tan 20 \text{ deg.}} = 0.0006 \text{ approx.}$$

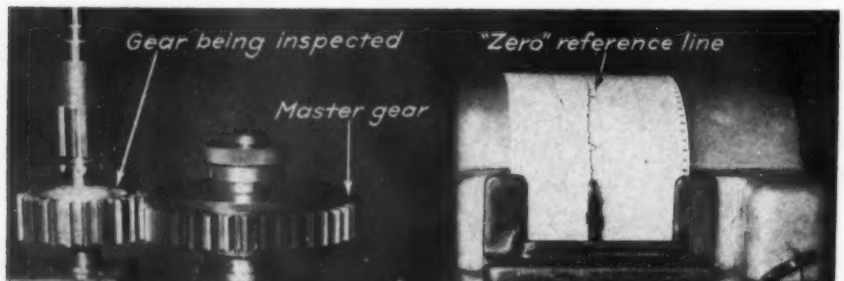
Total composite error = runout plus composite tooth error = 0.0014 + 0.0006 = 0.002 in.

$$\text{Center distance radius} = \frac{N}{2DP} = \frac{30}{2\ (16)} = 0.9375 \text{ in.}$$

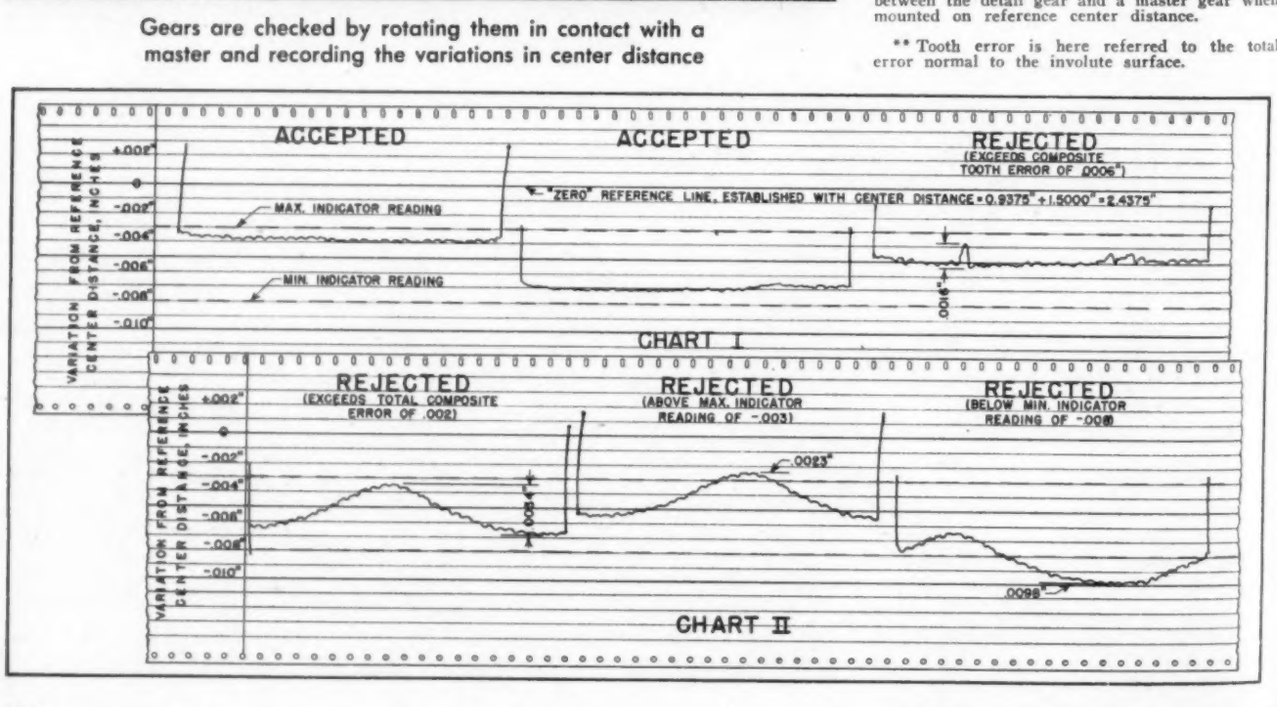
If the above were set up with a master gear of the following design:

48 teeth
16 DP
20 degree std. involute and addendum
Center distance radis = 1.5000 in.

Then the following typical charts I and II might be obtained of good and bad gears, if the center distance variations are recorded graphically and analyzed by the "Composite Gear Checking Systems."



Gears are checked by rotating them in contact with a master and recording the variations in center distance



* Backlash is here again referred to as the amount of tangential clearance that would exist between the detail gear and a master gear when mounted on reference center distance.

** Tooth error is here referred to the total error normal to the involute surface.

TABLE I — TOLERANCE FACTORS FOR DIFFERENT GEAR APPLICATIONS

	POWER TRANSMISSION		MOTION TRANSMISSION	
	Low Speed	High Speed	Adjustable Centers	Fixed Centers
Composite tooth error	Unimportant 0.001 to 0.002 in.	Very important 0.0003 to 0.0006 in.	Minor importance 0.0005 to 0.001 in.	Minor importance 0.0005 to 0.001 in.
Total composite error	Unimportant 0.002 to 0.004 in.	Important 0.001 to .002 in.	Very important 0.0005 to .0015 in.	Very important 0.0005 to 0.0015 in.
Difference of band between max. and min. indicator reading or size variation	Unimportant 0.004 to 0.010 in.	Unimportant 0.004 to 0.010 in.	Unimportant 0.002 to 0.010 in.	Very important 0.001 to 0.002 in.

The charts show that several gears failed for different reasons. This system of inspection clearly discerns whether or not a gear is acceptable or not. It must be recognized, however, that the exact nature and cause of rejection may require additional analysis by independent and more laborious methods.

Master Gears

This system is, of course, predicated on the availability of good master gears. Some of the gear companies, recognizing the soundness, simplicity and need for such a tolerance and inspection system, have cooperated excellently to perfect master gear manufacture on special orders for the precision gears required. Gears with narrow ranges of backlash, ones requiring uniform angular transmission, or ones which operate at extreme high speeds are not adequately checked by this method with ordinary commercial master gears The permissible errors in master gears, of course, must be consistent with the tolerance range or accuracy of the gears being checked. This is a fundamental that applies to all inspection methods and equipment.

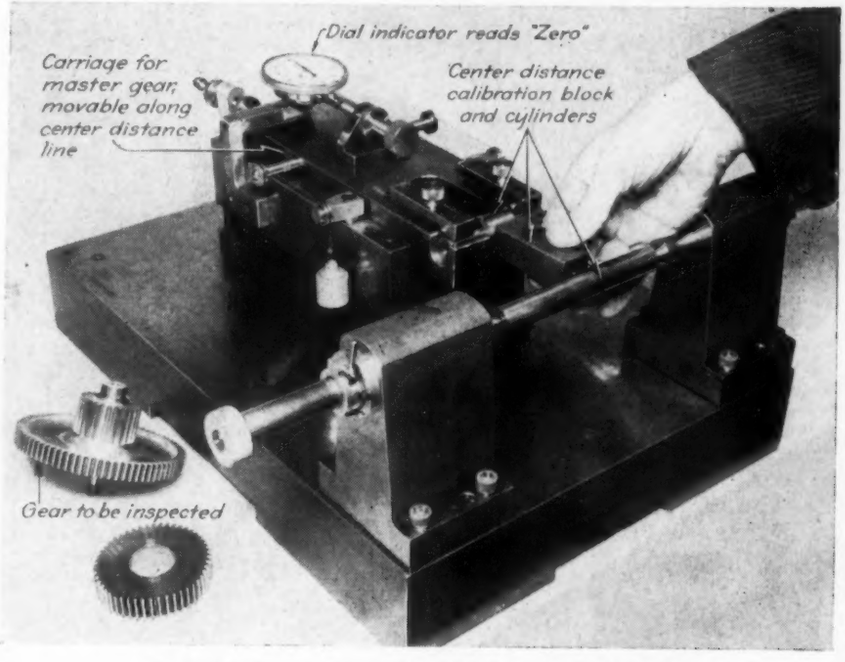
The size of the master gear should be approximately the same as the mating gear in order to probe that portion of the gear tooth involute surface which will actually be used in the particular application.

This gear system has been applied to many lines of aircraft, ordnance, Marine, and Signal Corps equipment. This equipment was made in General Electric plants and also by other companies as prime or subcontractors, bringing the total users to between 50 and 75 plants. The engineering, manufacturing and inspection departments of all of these plants were enthusiastic in their acceptance of the system when it demonstrated that precision gears could be produced, inspected, and assembled without selective assembly by semi-skilled employees, thereby resulting in more and better gear units with far fewer man-hours and at less cost than at first presumed to be possible.

Certain phases of this the "Composite Gear Checking System" have already been adopted by the American Gear Manufacturers Association in their standard 236.01 for fine pitch gears.

TABLE II—TOLERANCES TO BE SPECIFIED ON GEAR DRAWINGS

No. of teeth	30
Cutter diam. pitch	16
Cutter pressure angle	20°
Pitch diam.-in.	1.8750
Whole depth of tooth-in	0.143
Diameter over 0.108" OD pins-in	2.0208
Meshes with gear M-XXXXXXXP-X center distance radius-in	0.9375
Max. composite tooth error-in	0.0006
Total composite error-in.	0.002
Maximum indicator reading-in.	-0.003
Minimum indicator reading-in.	-0.008
Addendum is	STD.


Dial indicator reads "Zero"
Carriage for master gear, movable along center distance line
Center distance calibration block and cylinders
Gear to be inspected

Gage blocks can be used to obtain zero settings of inspection devices for the standard center distance

Diehead Troubles and Maintenance

BY H. SCHLARMAN, JONES & LAMSON MACHINE COMPANY

SELF-OPENING dieheads are designated as the revolving, or yoke type, and the stationary, or hand die. The revolving or yoke diehead is, as the name implies, opened and closed by a yoke or fork that rides in a groove around the diehead. The usual arrangement for opening the die at the end of the thread and closing it at the withdrawal is shown in Fig. 10.

The yoke has a hole that is a slide fit on a threaded bar. Jam nuts are adjusted in front of the yoke so as to stop the yoke and open the head at the end of the thread. Similarly, jam nuts are positioned in back of the yoke to stop it and lock the die on the withdrawal stroke of the die spindle.

Revolving heads do not have float built into them. Float is obtained through having a slight clearance between the die shank diameter and the bore of the spindle into which the shank fits.

The revolving die is used on any machine where the die spindle revolves, such as automatic screw machines, threaders, or drillpresses. The hand or stationary die does not revolve. It is most generally used on hand screw machines.

The hand die is so designed that when the operator stops its forward threading motion the die "pulls off," that is, the chasers retract from the thread and are free of the work. To close the die, the operator pushes the die-locking lever.

The stationary type die is used on certain Cleveland automatics as well as on all Brown and Sharpe automatics. The dies are automatically locked on these machines by a finger or cam arrangement.

All stationary dieheads should have float built into the heads to take up minor misalignment. Too much float in a head is as bad as none at all; the type of float is also important. The float arrangement should be such that it allows the whole head (from the shank out) to float freely in a vertical plane and not in one direction only.

An understanding of the sources of trouble affecting the operation of the diehead itself and of proper maintenance will aid in keeping equipment in use most efficiently

The shank of the stationary die, unlike the revolving, is never floated in its holder. However, the shank is often floated horizontally where dieheads are used on heavy turret lathes on which it is hard for the operator to start and follow the die properly. Horizontal die float is seldom used on ram-type turret lathes, but is a definite advantage on saddle-type machines particularly on fine threads.

It goes without saying that all the working parts of any diehead should be hardened and ground as required.

Dieheads of any type should be washed out in kerosene or gasoline every once in a while. This is particularly true if white lead or other heavy cutting lubricants are used. When cutting brass, aluminum or other soft materials, it is particularly important that the diehead should be cleaned at intervals as the fine paricles get into the die and weld themselves to the working parts.

Troubles in the die itself are easily spotted. Since the function of the head is to lock and unlock, failure to do so immediately indicates worn or broken parts.

If a die, either stationary or revolving, will either not lock or unlock on the machine, it is always well first to check the die out of the machine. This is done by clamping the shank in the vise and operating the head by hand. If the die does not work, something is wrong in the head that needs repair. If the head does work, it shows that there is something wrong in the hookup of the head in the machine or in the machine itself.

When a revolving die that locks properly outside of the machine but not in the machine, one or more of the following may be the reason:

1. Yoke may be too tight on the guide bar. When this happens the die may be locked on the retracting stroke of the die spindle. However, when the die spindle is pushed forward for the threading stroke, the yoke, being tight on the guide bar, will stick and try to stop the head which is being forced forward. This unlocks the die prematurely. The above may cause the head, dependent on its design, to be fully or partly opened before it reaches its threading position. Where the die is partly unlocked it may open while threading, before it has cut its full length of thread.

2. If the retraction and forward motion of the die spindle are very rapid and follow each other instantaneously, there may be a bouncing action as well as a time lag between the end of the retracting and the start of the forward strokes, that may be less than the time required for the locking mechanism of the die to work.

3. If the locking jam nuts are not set before the end of the retracting stroke, the yoke will, of course, not lock the die.

4. If the die locks on the retracting stroke but does not stay locked on the forward stroke, even though the yoke action was found to be all right, it would indicate that the wear on the operating mechanism was so great as to call for repair of the die itself.

Failure in Unlocking

If a revolving die unlocks when operated by hand and not when used in the machine, the reasons may be as follows:

1. The yoke may be too loose a fit on the guide bar. This would allow the yoke to cock and cramp the die against the thread.

2. If the die spindle is too much out of line with the stock spindle, so much pressure will be put on the

operating mechanism of the head while cutting, that the yoke pressure will not be enough to open the head.

3. On coarse pitches and tough materials, the chasers may have been worn into such a heavy bearing that they will hug the stock and prevent the die from opening. This will be explained in a later article.

4. Weak operating springs.

Yoke Design

When yokes are used on revolving heads these general facts should be remembered:

1. That part of the yoke that slides on the guide bar should be long enough to support the fork part.

2. The fit of that part of the yoke that slides on the guide bar should be a free sliding fit. However, it must not be excessively loose fit as it will allow the yoke to cock and cramp the diehead.

3. Yokes should be made of bronze where operated automatically. This protects the die because bronze has enough give to cushion the shock of opening and closing; the yoke will wear before the die; and in case of accident the yoke will give before the die or spindle.

4. The prongs of the fork part of the yoke should be long enough to reach ¼ to ½ in. beyond the center of the die.

5. The prongs should be so relieved that they contact the die only near the centerline of the head. This assures that the operating pressure of the yoke will be applied at a point on the same centerline as that of the diehead and spindle. It prevents the yoke from contacting the die and exerting the opening and closing pressure above or below the centerline of the die which would cramp and cause needless wear on both the die and spindle.

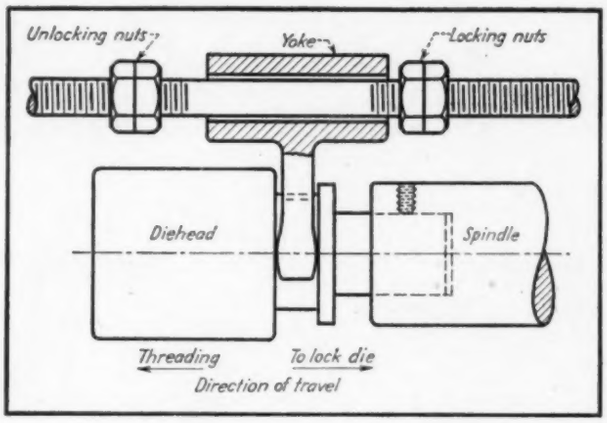


Fig. 10—Jam nuts on a threaded bar are a common means of actuating revolving self-opening dieheads

6. The pronged part of the yoke should have clearance over both the diameter and width of yoke groove on the die. The yoke should never "ride" the die as this will cause a cramping action.

Stationary dies, being hand-operated, do not offer the problems of the revolving dies.

If a hand die refuses to lock there is something wrong in the head; either the head is dirty or there are worn or broken parts. If a stationary head cannot be "pulled off" by hand it is also proof that there is something wrong in the head.

When a stationary head will pull-off by hand and not when cutting a thread the causes may be any of these:

1. Excessive misalignment between die and stock spindle. Alignment should be checked in both horizontal and vertical planes.

2. Excessive bearing in chasers.

3. Weak operating springs.

Sometimes the cause of a head not opening or closing properly lies in the dimensions of the chasers, or chaser holder tongues. This can be checked by operating the head with either the chasers or holders (whichever the case may be) out of the head.

It sometimes happens that one or more chasers may be too thick or wide or the cam surfaces (if of that type) too narrow. By operating the head with only one chaser assembled in it at a time, the troublesome one can be segregated. This also applies to chaser holders.

TIPS for Top Shop Men

50 Build team spirit. Try to make each individual feel he or she is part of a team—and does just as important a job in taking out blocks as does the man carrying the ball.

51 Act as a go-between for workers and management. Explain the position and attitude of each to the other. Wear no man's collar.

52 Look just as hard for things to praise as you do for things to criticize. Mistakes are easy to find and fuss about. It's harder, but better, to find good work and pass on a compliment for it. A pat on the back will raise morale—and production—far faster than a hard-boiled bawling out.

53 Encourage workers to do each job better, and work out a plan for promoting those who respond. This is a trump card in handling people.

54 When you train or instruct a man, have him go through the new job once while you watch. It will give him confidence and show you whether or not you've done a good job.

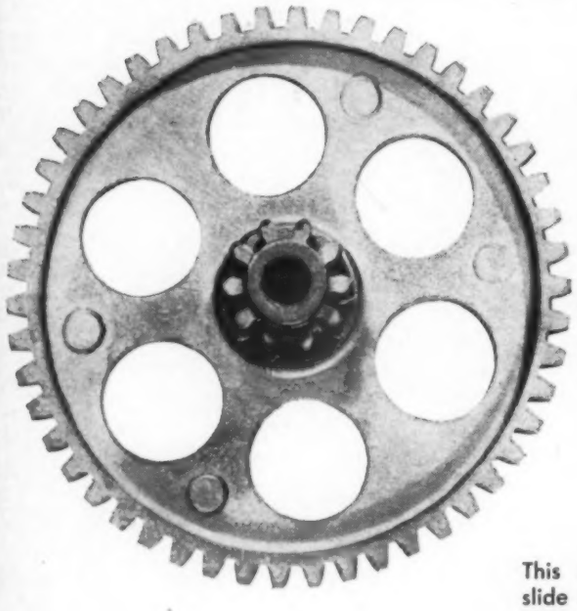
55 Management may be crippled today by misunderstanding resulting from loss of worker contact resulting from skyrocketing of personnel and rapid turnover. It is your job to fill that gap—laying the cards on the line for men above you just as you do to those below. If some policy or decision is causing discontent, say so, and suggest a solution or modification before it grows into a full-blown grievance.

56 Safety instruction is vital with new or green workers. Hammer at it. Quote often the basic shop rule, "Don't touch *anything* that doesn't concern you." That avoids spoiled work, lost tools, *and* cuts accidents.

LOST-WAX PROCESS
Precision-Casts Superalloys

Here, in shop-shot sequence, are 25 of the steps in mass-producing parts of stainless, chrome-steel, Stellite and Hastelloy at the Kokomo (Ind.) plant of Haynes Stellite Division, Union Carbide and Carbon Corporation.

Tolerances can be held to 0.003 in., weights from 0.002 to 5 lb. (by pressure casting), sizes to 8 in. each way, edges as thin as 0.010 in. Typical parts are pictured below, production steps on the next three pages.



Precision-cast to finished dimensions, this Hastelloy C gear for a steel-mill pickling tank avoids much machining. Diesel pre-combustion cups, glass-mold elements and like parts for high-temperature service are cast in this alloy and finished by grinding

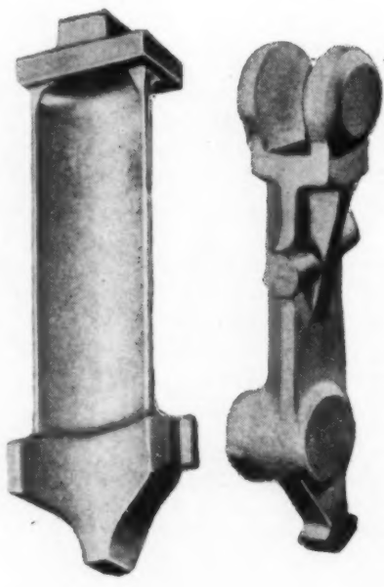
This 2 1/8-in. reciprocating slide for a cloth-cutting machine is cast of Stellite No. 6 and requires only four grinding operations to finish. It outlasts tool steel 3-1, avoids 42 machining operations, heat-treatment, and four grinds when the part is turned from bar

Feed dog for an industrial sewing machine, cast of Stellite Star J-metal, a hard, abrasion-resistant alloy difficult to machine. Other parts similarly cast include rock-drill pawls, canning machine and projector parts. Costs in quantity production run under 5 cents

This is one of a series of parts for spray nozzles used in production of explosives. Of Hastelloy C, it has 3/8-in. pipe threads outside, 7/16-20 N.F. threads inside, is only 1 in. long over-all

← For an airplane fuel tank, this valve part is of Stellite J-metal. Here, as in other parts, usual physical properties of the material can be developed and machining limited to grinding on mating surfaces

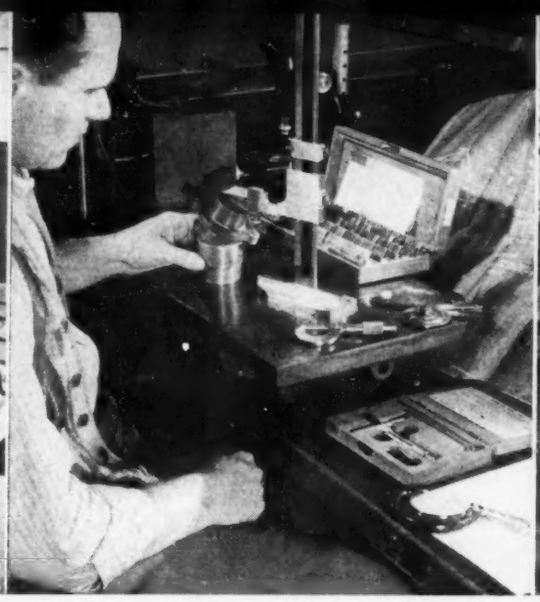
War emphasis on precision casting resulted from jobs such as this—a turbo-supercharger bucket of Stellite 21, produced at a rate of two million a month. Other designs were for jet engines and gas turbines, embody compound-curved contours and thin edges →



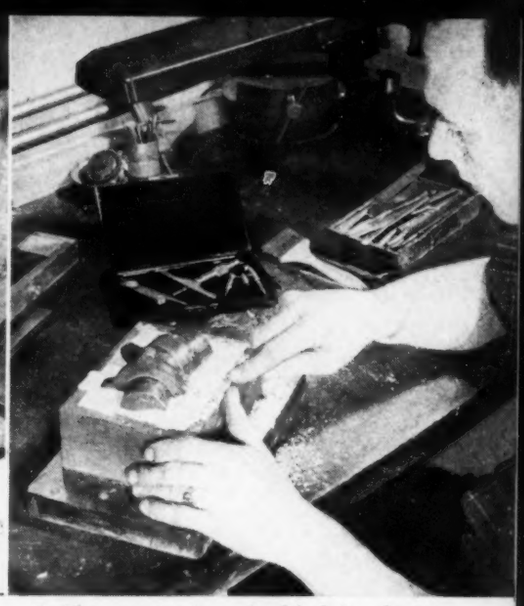
← This aerial-camera crank, of stainless 410, is 2 1/8 in. long over-all, with several tolerances of 0.005 in. and a 1/4° tolerance on angularity in the central hub

This valve part, of J-metal, is for an oil refinery. Other peacetime castings include horseshoe caulks of 12% chrome steel, zipper slides of Hastelloy C and squirrel cages of stainless steel →

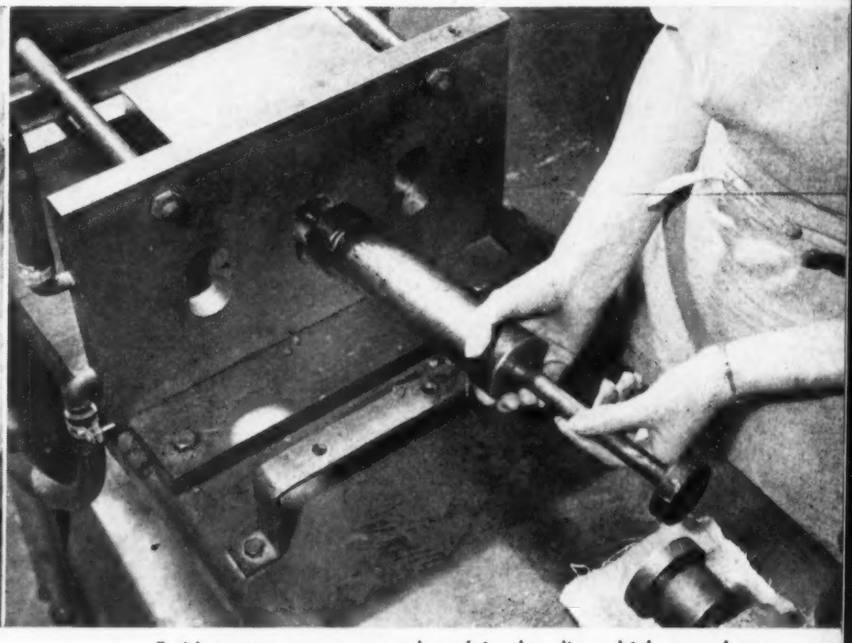
. Wax for the process is carefully lended, then molded in blocks, later elted to load the injection guns (Photo 5)



2. A master pattern of brass, steel, wood, etc., depending upon part design, is made oversize, to allow 1½% for shrinkage



3. The master is embedded in plaster in the "drag," so the upper half of the injection die can be poured

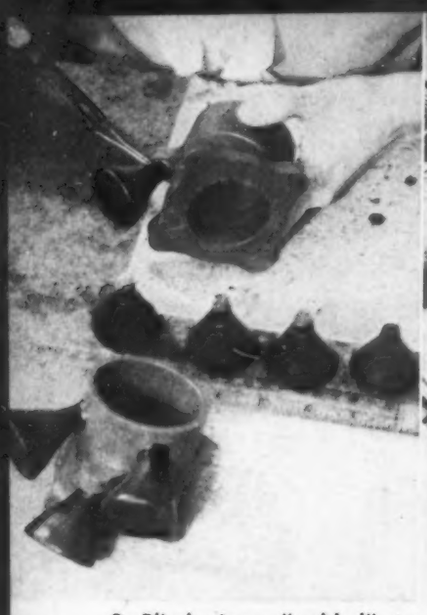


4. Molten soft metal is poured under pressure to make the upper die half, then the plaster is removed and the lower half poured

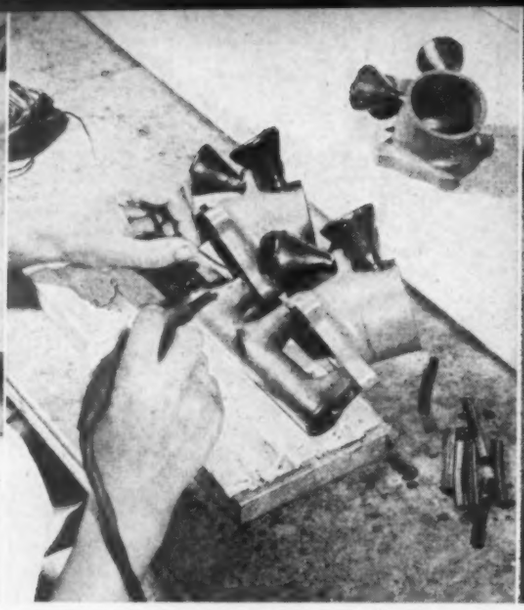
5. Necessary cores are placed in the die, which may have 20 cavities in the case of small parts, and wax is injected by this pressure gun, operated by a pneumatic ram

6. The wax pattern (or patterns) is removed from the mold, cores taken out and the wax gate broken off. Die halves and rough wax patterns can be seen at right

7. Inspection and assembly to gates and risers by "wax welding" occur along a conveyor line. Here the operator is checking for dimensional accuracy

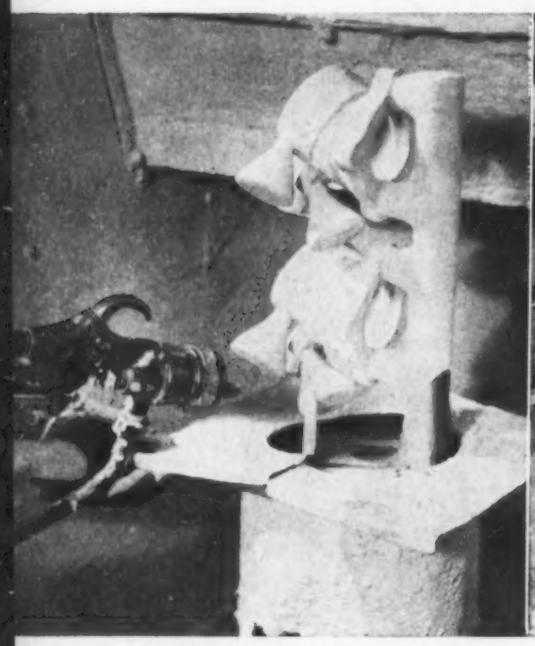


8. Blind risers "welded" to patterns get metal to all areas and provide for shrinkage



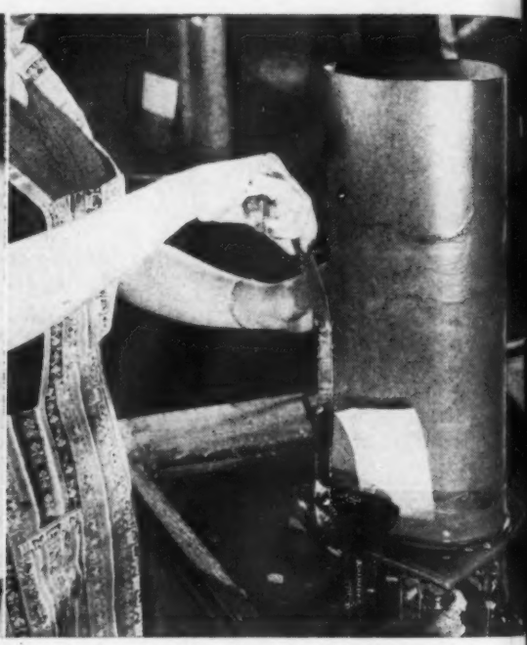
9. Two wax patterns are mounted on a main gate with wax runners. Again the resistance loop heats, wax "wire" is the rod

10. The assembly is dipped into fine silica suspended in a suitable medium. This fine material later forms the inner mold surface



11. After dipping, pouring end of wax assembly is mounted on a square base. Uncoated areas are silica-sprayed

12. Somewhat coarser silica is screened or "stuccoed" to the dip coating in this special cabinet



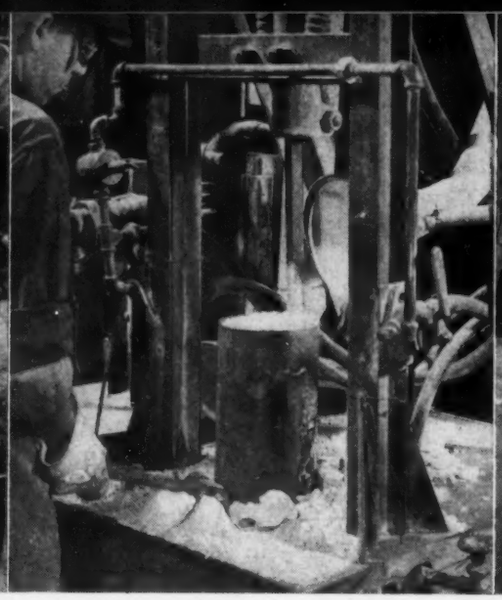
13. After a 22-min. drying pass through an oven, a flask of Hastelloy C is sealed to the square base. Wax paper catches surplus metal

14. A hanger conveyor carries the assembly to the investment-material mixer, where the tube is filled

15. Molds go on a vibrator, or shaker table, which packs investment material tightly around the wax, removes air, causes fines to rise

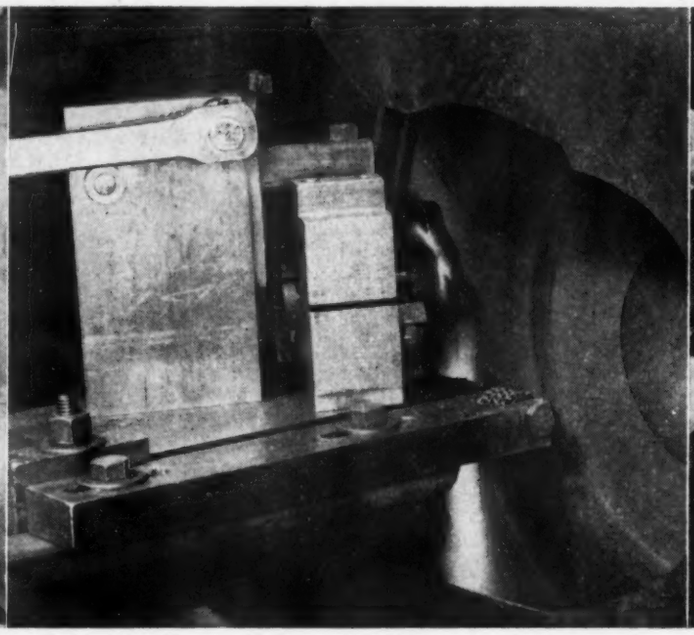
16. Excess investment is power-sawed off, the steel plate removed, and molds inverted in a furnace to burn out wax

17. Alloy is mixed, melted in this furnace. The baked, hot mold is clamped over the spout, the assembly inverted and air pressure applied



18. After cooling about 4 hr. the assembly is removed by pneumatic hammer and investment material removed

19. Conveyors carry castings to abrasive cut-off wheels, where gates and risers are removed



20. Castings are shot-blasted, then inspected. Thin-edged castings are hand-cleaned

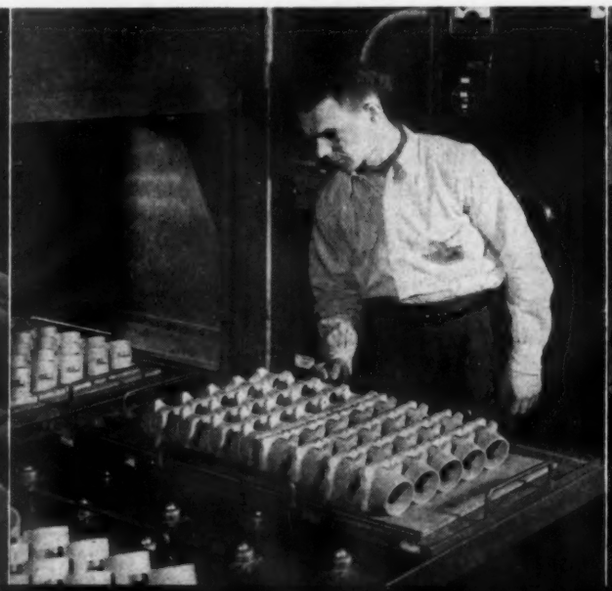
21. Gate areas are smoothed and surface irregularities removed by grinding, bores being touched up with an internal grinder

22. Surfaces are sand-blasted, inspected visually and dimensionally

23. Zyglo test (penetrative oil viewed under black light) follows preliminary inspections

24. Automatic X-ray equipment checks all castings in tray lots, except larger Hastelloy castings, where gamma ray is required by alloy density

25. Trained operators check all X-ray negatives for flawed parts (numbered to permit check of customer's inspection)



Fact-finding is an important phase of tool planning. Proposed plans are discussed in detail before action is taken. Here, Frank Cuthbertson, chief tool engineer for the A C Spark Plug Division, General Motors Corporation, discusses a tooling plan with John Brywick, a tool designer

Tools for Sound Production Planning

BY WALTER F. EITEL

SUPERVISOR OF METHODS, A C SPARK PLUG DIVISION, GENERAL MOTORS CORPORATION

In this second and final article on planned tooling, the author reviews items which he believes aid the thinking of tool engineers in methods - planning programs

TOOL PLANNING ENGINEERS object to any hard and fast formulas for their operations. There are, however, basic considerations which prove invaluable in planning a job soundly and thus eliminate the need for corrective factors after a project has been tooled up.

Four basic considerations for tool planning engineers are: a questioning attitude for fact-finding; the act-breakdown to analyze the job step-by-step; movement analysis to study the operator's part of the job and to design the equipment to fit the operator; and movement time value to help him calculate equipment capacity.

The first planning tool is a fact-finding instrument and may be defined as "an expression of the urge to get all the facts concerning a problem or a job. It is a mental attitude and some people possess it more than others."

Planning engineers and designers can develop the questioning attitude rapidly by making it a habit to question the four planning factors: product design, material economy, tooling economy, and motion economy. Any one of the factors can be affected by any of the others. For example, the design of the product will be strongly influenced by the type or amount of material to be used. Tooling will depend on the product design or the material used. Motions used by production operators will be determined by the type of tooling, the material, and product design.

Once the engineer has learned to recognize the influence which product design, material economy and motion economy have on his tooling equipment, he has made a step in the right direction.

The Act-Breakdown

The act-breakdown also can be used to develop analytical thinking. The engineer's job consists primarily of thinking, and many planning engineers have developed shortcuts to save time. But these shortcuts are frequently sources of errors. They usually consist of assumptions based on past experience. The act-breakdown does not allow any such shortcuts.

Once the planning engineer knows what is to be done to the product, he can easily figure out by using the act-breakdown what physical work is necessary to do the job. Then he can record this physical work of the operator step-by-step. Only when this has been done should he start to visualize what type of equipment will be necessary to satisfy the conditions set up by the act-breakdown.

From a motion-economy point of view, the job which can be done without any physical work by an operator is the best because it makes the operator's time available for other effective work. There the act-break-

down would show no work at all:

1.

Left Hand	Right Hand
XXXX	XXXX

The next best solution from a motion economy viewpoint would be where the operator does not do anything but get the part and place it into the equpiment. On the act-breakdown this would appear as follows:

2A.

Left Hand	Right Hand
Get Part	Get Part
Place Part	Place Part

(or, alternating hands)

2B.

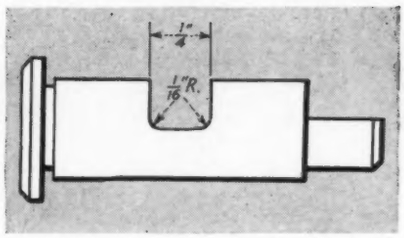
Left Hand	Right Hand
Get Part	Place Part
Place Part	Get Part

A third solution would consist of getting a part, placing it into the equipment, operating the equipment, getting the finished part out of the fixture, and disposing of it. This would take the following form on the act-breakdown, see box 3 below.

The different types of equipment necessary to satisfy the conditions which have been set up under the different act-breakdowns are:

1. The first case involves an entirely automatic machine.

2. In the second case the equipment would have to be such that it could be loaded by the operator during the process or machining time. For example, a chain broach or a rotary



Part chosen as example

machine with automatic index and ejector, conveyor, etc.

3. The third solution would require equipment where the cycle is started by means of two-hand controls. (Power broach, punch press, etc.)

In some cases the act-breakdown is not a fine enough tool to get all the facts a planning engineer may need to make a decision. For example, if he has to make a close comparison of the hourly production obtained by two methods on a high-production job, or if he has to forecast equipment capacity to provide enough capacity for the job, the *movement analysis* and *movement time values* are the tools which give him this information.

Movement Analysis

The *movement analysis* is a finer breakdown of each individual act into elementary movements, in preference to using therbligs. For example, if an operator has to place a part into a drill fixture over two locating pins, the movements for the place act would be recorded as shown in the accompanying chart.

An accurate movement analysis without time values would be not only impractical but impossible because the time necessary to perform elementary movements varies with the length of travel and also is greatly influenced by the use of the eyes. The accuracy of the time values is relatively unimportant as long as they are used consistently. Planning engineers can learn how to make a reasonably accurate analysis of a job using only six time values. They are not expected to become expert analysts, but rather to have a reasonable working knowledge so that they can appreciate the value of motion study as an aid for the designer. As a result they will ask the trained methods analyst for an analysis where necessary.

The movement analysis is essential when selecting the most economical process and equipment for a job under any given conditions. A simple case study typical of the type a trained methods analyst might make will serve to illustrate this point.

The eccentric pin above must be slotted, and the most economical method should be selected. It is known this job can be done in many different ways, from a hopper fed chain broach to a hand mill with a simple fixture. To determine the most economical method it is necessary to calculate the unit cost for each method, considering only labor and tooling cost. The material cost, being the same in all cases, can be omitted. For simplicity's sake the overhead burden also has been omitted in this example.

In making a movement analysis, it

3.

Left Hand		Right Hand
Get Machine Control		Get Machine Control
Place Machine Control		Place Machine Control
Wait	Process	Wait
Get New Part		Get Finished Part From Machine
Place Part Into Machine		Dispose of Part In Pan

MOVEMENT ANALYSIS BREAKS DOWN ACTS INTO ELEMENTS

LEFT HAND			EYES		RIGHT HAND			
ACT. TIME	MOVE TIME	MOVE-MENT	DESCRIPTION		DESCRIPTION	MOVE-MENT	MOVE TIME	ACT. TIME
0.013			PLACE GAGE IN FIXTURE		GET DRILL PRESS HANDLE			0.013
	0.005	FA-ED	Move hand to fixture		Move hand to handle	FA	0.005	
	0.003	OR-FA	Move down over 1st pin		Close fingers	FS	0.001	
	0.003	OR	Shift eyes to 2nd pin		Wait	W	0.007	
	0.002	FA	Move down over pin					

ESTIMATED COST OF SLOTTING ECCENTRIC PINS BY DIFFERENT METHODS

	Type of Equipment	*Equipment Cost	Production per hr.	Hr. labor per 1000	**Labor cost per 1000 assuming $2. per hr. for labor and burden	Labor savings per 1000 as compared against Method 5	Production Schedule required to justify equipment cost over Method 5
1)	Power Broach, continuous chain type	$14,000 1 machine +tooling	1652	0.6 hr./M	$1.20	$2.80	$\frac{13900 \times 1000}{2.80} = 4{,}970{,}000$
2)	Automatic Mills with double air-operated fixt. 2 machine rate	$6,000 2 machines +tooling	840	1.18 hr./M	$2.36	$1.64	$\frac{5900 \times 1000}{1.64} = 3{,}600{,}000$
3)	Handmill—air-operated double fixture and air-blowout	Mill available $400 2 fixtures	900	1.04 hr./M	$2.08	$1.92	$\frac{300 \times 1000}{1.92} = 156{,}000$
4)	Handmill—single air-operated fixt. and air-blowout	Mill available $250 1 fixture	630	1.59 hr./M	$3.18	$0.82	$\frac{150 \times 1000}{0.82} = 189{,}000$
5)	Handmill—single fixture hand-clamp and air-blowout	Mill available $100	500	2.00 hr./M	$4.00		

*The equipment cost is only approximate. **The labor and burden rate is an assumed rate.

is determined an operator can handle with ease approximately 3,000 pins per hr. using the method shown in the box at the foot of the page.

The ideal loading time thus is 0.036 min., but when a machine is running continuously on such a short cycle any fumbling on the part of the operator means an empty station. For this reason a fumbling allowance of approximately 10% should be added to the ideal cycle to determine the maximum speed of the machine from the operator's viewpoint, or 0.004 min. in this case. The machine cycle then would be 0.040 min. for two pins, or $60. \div 0.040 \times 2 = 3{,}000$ pieces per hour.

In the above analysis the following conditions must prevail:

1. The machining must not interfere with the loading.
2. Automatic clamping of parts.
3. Eject parts automatically.

These conditions should be satisfied by a continuous broach or an automatic mill. Speed and feed calculations indicate the parts can be broached at a rate of 3,200 pieces per hr. However, there is a limiting condition which must be taken into consideration. In loading the continuous broach, the operator is compelled to sit sideways at the machine because there is no leg room. As a result of the operator's awkward position he will either resort to loading with one hand—getting the part with the left hand from the supply container, transferring it to the right, and loading the fixture with the right only (this involves more movements than were assumed in the original estimate and consequently more time), or the operator will have to add at least two body movements to the original cycle. This increases the cycle time to 0.058 min. for two pieces, or a production of 2,065 pieces per hr. at a machine efficiency of 100%. This gives us an hourly production of 1,652 pieces at a machine efficiency of 80%, or 0.6 hr. per 1,000 pieces.

Where the operation is performed in an automatic mill using a double fixture, the loading would take 0.040 min. for two pieces plus 0.010 min. for starting the machine cycle. Feed and speed calculation indicates:

The rapid approach of 8 in. takes	0.02 min.
The actual milling cut takes	0.06 min.
The return of the table takes	0.02 min.
Total machine cycle..	0.10 min.

Since the operator cannot do anything during the machine cycle, a second machine could be provided to be loaded automatically. The operator then would have to move from one machine to the other by making a turn of several steps. The difference between the machine cycle and the operator cycle is:

Machine cycle	0.10 min.
Operator cycle	0.05 min.
Difference	0.05 min.

This 0.05 min. is sufficient to make a turn or several steps, therefore, when two machines are used it is possible to get two pieces every 0.10 min. or $60. \div 0.10 \times 2 = 1{,}200$ pieces per hour.

Since there are two cutters which have to be ground in pairs on each arbor, the down time of these machines will be rather high. Considering this factor, the machining efficiency will be about 70 to 75%, or a production of 840 to 900 pieces per hr. can be expected from two machines. This, in turn, represents 1.18 hr. per 1,000 pieces.

Carrying the example still further by taking more and more work from the machine and giving it to the operator, the job can be done:

A. On a hand mill with double air-operated clamping fixture and an air blowout at a rate of 900 pieces per hr.

B. On a hand mill with a single air-operated clamping fixture and air blowout at 630 pieces per hr.

C. On a hand mill with a single hand-clamping fixture at a rate of 500 pieces per hr.

Having this information, the tooling and equipment cost, and the anticipated production, it is simple to determine the most economical tooling for the anticipated production requirements, as in the table above.

Left Hand		Right Hand	
Min.			*Min.*
0.016	*Get pin* from container	*Place pin* in machine	0.020
0.020	*Place pin* in machine or fixture	*Get pin* from container	0.016
0.036 Min.		For 2 pins	0.036 Min.

AN American Machinist REPORT TO THE METALWORKING INDUSTRIES

HOW TO WORK with PLASTICS

BY HAROLD L. FLYNN
Associate Editor

A natural for quantity production of eye-appealing molded products, plastics during the past ten years have gained increasing recognition as versatile engineering materials. In World War II, critical shortages of other materials resulted in hundreds of new and practical industrial applications of all types of plastics. Today, a working knowledge of plastics and molds and dies for them is indispensable to production men. Latest available information from dozens of sources is condensed here into a 20-page practical handbook.

ALTHOUGH the first commercial plastic material, cellulose nitrate or Celluloid, was put on the market as far back as 1872, and phenol formaldehyde as long ago as 1909, the plastics industry has had its most rapid growth since 1925. Since that time, no less than 18 new basic plastic compositions have appeared on the market, most of them appearing in the late 30's and early 40's. And each of these materials is capable of modification and formulations to give a wide range of properties.

The chemistry of plastics is a branch of organic chemistry embracing the multitudinous compounds of the element carbon. Modern plastics are combinations of two or more of only five of the 92 chemical elements in the classical periodic table of elements. Of these five—carbon, hydrogen, oxygen, nitrogen and chlorine—carbon is in a chemical sense the backbone, the chemical common denominator of all organic plastics.

Whatever the ultimate plastic product may be, it is almost always a composite material consisting of a complex synthetic resin or semi-synthetic chemical body combined with other ingredients called fillers or plasticizers. These ingredients are mixed with the resins to modify their properties and make them suitable for practical use. The resins may be solid or liquid substances of complex (mostly non-crystalline) chemical structure and are built up by chemical reactions between relatively simple compounds.

Featuring:

1. *Materials Classification*
2. *Molding Procedures*
3. *Types of Molds*
4. *Mold Construction and Design*
5. *Machining and Cutting*
6. *Finishing*

Most intense research on materials is for the development of plastics with greater impact strength and higher heat resistance. The development of equipment to mold bigger and heavier plastics parts in shorter cycles is another goal. In the field of thermosetting materials, the use of mineral and asbestos fillers has appreciably raised the heat resistance of many plastics. Glass-fiber fillers have brought greatly increased tensile strengths to molded and laminated materials. Stability of materials has been increased by better control of manufacturing equipment and procedure, giving to the engineer a structural medium of known dimensional characteristics.

COMPARATIVE PROPERTIES OF COMMON PLASTICS

Materials	Filler or Condition	Compression Molding Pressure M-LB	Compression Molding Temp. Deg. F.	Injection Molding Pressure M-LB	Injection Molding Temp. Deg. F.	Mold Shrinkage In. per In.	Bulk Factor	Tensile Strength M-LB	Compressive Strength M-LB	Elongation %	Rockwell Hardness	Thermal Expansion	Heat Distortion Point, Deg. F.	Dielectric Constant, 60 cycles	Color Range	Optical Quality	Machinability
THERMOSETTING:																	
Phenol-Formaldehyde	Wood Flour	2.5-4.5	275-400	3-15	3-18	0.004—0.010	2-6	7-10	25-35	0.5-0.9	120-130M	3-4	300	7-9	L	O	M
Laminated	Paper	1.5-3	275-375	—	—	—	2-3.5	8-20	20-38	—	80-125M	1.6-2.4	300-320	—	L	O	G
Cast	No Filler	—	—	—	—	—	—	9-10.5	20-26	—	60- 75M	7-11	150-170	7-8	UL	T-L-O	E
Phenol-Furfural	Wood Flour	1 -5	325-400	.5-9	.5-10	0.005—0.009	2.75	6-9	27-37	0.2-0.4	65- 80B	3.5	275	6-9	L	O	M
Melamines	Cellulose	1.5-5.5	280-350	—	—	0.008—0.014	2.5	8.5-14	26-37	—	90-110M	.5	390	9-10	UL	T	F
Ureas	Cellulose	1.5-5.5	290-330	—	—	0.005—0.010	2.75	8-13	25-32	—	100-125M	2.75	250-285	7-8	P	L-O	F
Vulcanized Fiber	—	—	—	—	—	—	—	6-11.5	20-33	—	80- 90M	—	—	—	L	O	G
Lignin-Laminated	—	1 -2.5	280-370	—	—	—	2-3	8-12	25-32	—	100-110	2.25	—	—	L	L-O	G
THERMOPLASTICS:																	
Cellulose Acetate	Resin	1 -5	250-350	10-30	350-450	0.002—0.009	2.5	3-9	6-28	5-45	75-125R	7-15	130-220	3.5-7	UL	T-L-O	G
Cellulose Acetate Butyrate	Resin	2 -5	250-320	10-30	340-410	0.002—0.009	2.5	3-7.5	7-25	40-90	60-120R	10-16	120-190	3.5-7	UL	T-L-O	G
Ethyl Cellulose	Resin	1 -5	250-370	10-30	350-450	0.002—0.010	2	3-9	9-22	10-100	30-110R	9-14	120-210	3-5	UL	T-L-O	G
Cellulose Nitrate	—	2 -5	170-240	—	—	—	—	4-10	20-30	30-40	100-130R	5-12	120-170	6-8	UL	T-L-O	G
Polystyrene	Resin	1.5-4.5	280-340	10.5-35	380-475	0.002—0.008	2.2	6-7	12-15	2-4	80- 95M	5-8	170	2-5	UL	T-L-O	F
Polyethylene	Resin	.5-1.2	250-330	5-20	325-425	0.03—0.06	3.5	1.8-3.5	11-15	60-500	30-35R	60-120	180	2.25	UL	L-O	G
Nylon	Resin	—	—	3-10	475-575	0.004—0.012	2.5	9.5-11	14-17	40-60	80-90M	8-12	325	4	UL	L-O	E
Methyl Methacrylate	Resin	1-2.5	275-375	10-35	315-475	0.001—0.006	2	5-11	10-16	2-14	60-120M	8-10	170-190	3.5	UL	T	E
Methyl Methacrylate	Cast	—	—	—	—	—	—	6-12	11-14	2-14	110M	7-9	175	3.5	UL	T	G
Vinyl Chloride Acetate	Rigid	1.5-2.5	275-325	15-35	275-325	0.002	2	7-10	—	—	30-60M	6-8	150	3.5	UL	T-O	G
Polyvinyl Chloride	—	.5-1.2	280-360	20-25	300-375	0.008—0.016	1.5	1.5-8.5	4-6	10-500	30-50M	4-7	225	7-11	UL	T-O	F
Vinylidene Chloride	—	1-4	220-350	10-27	275-400	0.004—0.014	2.2	4.5-8	8-9	15-45	50-70M	15-18	180	3-5	B	L-O	G
Polyvinyl Butyral	Rigid	1-2.5	275-325	—	—	0.005—0.015	1.5	5-9	9-14	10-50	40-60M	10-20	135	3.5	UL	T-O	G

NOTE: Values in most cases are approximate and depend on size, design of part and formulation of compound. COLOR RANGE: L = Limited, UL = Unlimited, P = Pastels, B = Broad
OPTICAL QUALITY—T = Transparent, L = Translucent, O = Opaque THERMAL EXPANSION—10^{-5} per deg. C. MACHINABILITY: M = Medium, G = Good, E = Excellent, F = Fair

MATERIALS

CHARACTERISTICS AND ORIGINS

TWO BASIC TYPES of plastics are today at the disposal of industry, thermosetting and thermoplastic. Thermosetting materials are cured to an infusible state by heat and pressure and cannot be re-used. Thermoplastic materials soften under heat and pressure and set to a hard or semi-solid condition when introduced to a closed, relatively cool mold or returned to room temperature. Upon further application of heat they will become soft and may be used again. Color may be incorporated in depth in most materials falling under both of these types.

Grouped under this major division are these materials:

Thermosetting

Allyl Alcohol	Phenol Formaldehyde
Furfural Formaldehyde	Polyester
Melamine Formaldehyde	Urea Formaldehyde

Thermoplastic

Acrylics	Polydichlorostyrene
Casein	Shellac
Cellulose Acetate	Vinyl Acetate
Cellulose Acetate Butyrate	Vinyl Butyral
Cellulose Nitrate	Vinyl Chloride
Ethyl Cellulose	Vinyl Chloride Acetate
Polystyrene	Vinylidene Chloride
Polyamides	
Polyethylene	

These materials vary widely in physical and chemical properties and lend themselves to certain established processes. In brief, their properties can be covered under groups:

PHENOLIC GROUP

THE PHENOLICS are synthetic compounds derived from coal-tar acids and are procurable as conventional phenolic resins to which fillers are added and then molded by compression or transfer; cast phenolics; casting resins and laminating resins. By adding different types of fillers such as wood flour, chopped fabric, mica, asbestos molding compounds with varying properties are obtained. Phenolics are extensively used in adhesives, paints, varnishes and abrasives.

Fillers are very important components of the molding compound and often account for 50% or slightly more of the weight of the material.

AMINO GROUP

UREA FORMALDEHYDE and melamine formaldehyde, both thermosetting, are included in this group and provide a wide color range, color stability and good electrical characteristics. Ureas are derived by combining urea and formaldehyde through condensation and are available as molding compounds, laminating resins, glues, surface coatings and paper-treating resins. Many of their characteristics are like those of phenolics.

Melamines are closely related in composition and characteristics to the ureas and are derived from calcium cyanamid reacted with formaldehyde. The resins are blended with cellulose fillers or chopped rags to form molding compounds and they are also widely used as laminating resins. They have higher resistance to heat, water and chemicals than the ureas, and combined with mineral fillers have the highest arc resistance of any molding compound.

CELLULOSE GROUP

AMONG THE leading materials used in the industry, this group includes cellulose nitrate, produced from wood cellulose or cotton linters, treated with sulphuric and nitric acids and plasticized with camphor, cellulose acetate, produced from cotton linters combined with sulphuric acid, acetic acid and acetic anyhydride, cellulose acetate butyrate, produced from cotton linters treated with acetic acid, acetic anhydride, and butyric acid and ethyl cellulose, derived by treating cotton linters with caustic soda and ethyl chloride.

All but cellulose nitrate are available as molding and extruding compounds, sheets, rods, tubes and film. Cellulose nitrate is supplied to fabricators in the form of sheets, rods, tubes, films and emulsions. Fabricating characteristics are good.

VINYL GROUP

ALL OF THE VINYLS, which include vinyl acetate, vinyl butyral, vinyl chloride-acetate, vinylidene chloride and polyvinyl alcohol are thermoplastic.

Vinyl acetate is an adhesive base widely used as an interlayer for safety glass and for bonding cloth, paper, glass and other materials. All others except vinyl chloride acetate can be molded and extruded and have replaced rubber in many applications.

POLYAMIDE GROUP

NYLON is the generic term applied to this group. All can be molded and extruded and are easily machined. They have heat resistance up to 380° F.

POLYSTYRENE GROUP

RELATED to the vinyl resin group but is generally distinguished from resins in that group. Produced from benzene and ethyl chloride, these materials are available in sheets, rods, tubes, molding compounds and for laminated materials. They are, incidentally, among the cheapest and most useful materials available.

POLYETHYLENE GROUP

A RELATIVELY new, flexible and translucent material which can be processed by all the methods used for the other thermoplastics, extruded as filaments, fabricated into sheets and film and coated on cloth. It is a solid polymer of ethylene, extremely light in weight and low in water absorption.

ALLYL GROUP

A NEW TYPE of thermosetitng plastics derived from allyl alcohol, these are the nearest approach to glass yet produced by the plastics industry. They combine low volume change during cure with good electrical, chemical and optical properties. Used with glass fibers, they produce laminated materials that are practically transparent.

ACRYLIC GROUP

METHYL METHACRYLATE is an important resin of the acrylic type and is a thermoplastic produced by treating propylene, a petroleum derivative, with acetone and methyl alcohol. While relatively soft, with a tendency toward scratching they can be refinished easily by polishing and buffing. They were widely used as transparent enclosures for aircraft during the past five years and have many peacetime applications. The material is available in molding powder and also in sheets, rods and tubes. The powder requires very heavy pressures and seems to require at least 1/16-in. thick walls to flow.

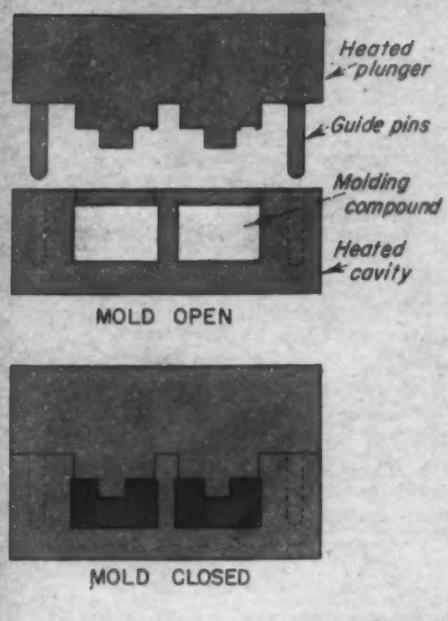
CASEIN GROUP

AN AVERAGE COW'S milk carries in suspended or colloidal condition about 3% of casein, which is best described as phospho-protein, a lime compound in combination with calcium phosphate. Rennet is added to give the toughest finished raw material. Available in sheets, rods and tubes.

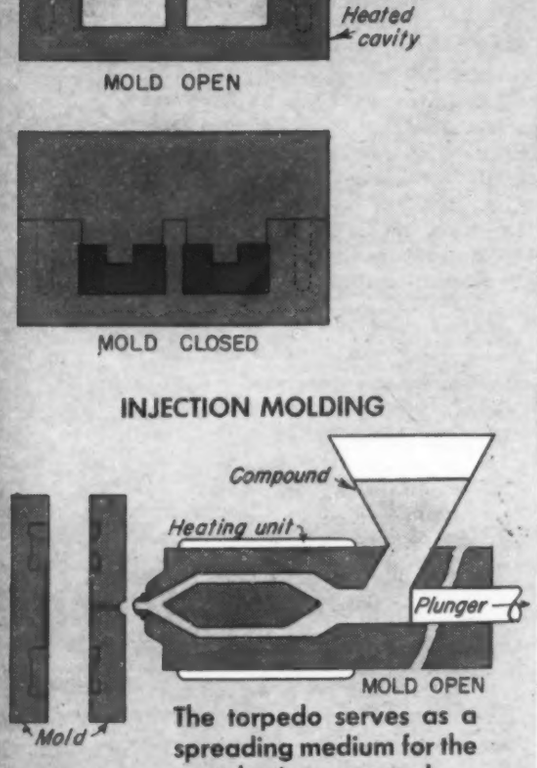
MOLDING

BASIC METHODS AND REQUIRED EQUIPMENT

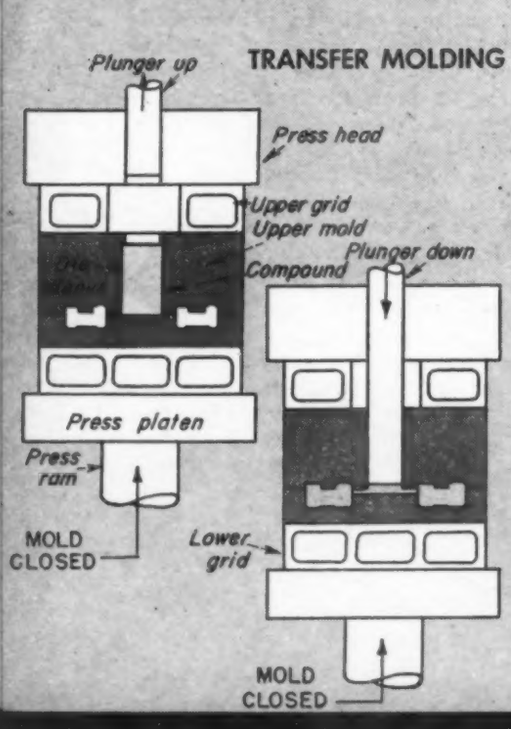
COMPRESSION MOLDING



INJECTION MOLDING



TRANSFER MOLDING



COMPRESSION MOLDING is one of the oldest methods of converting plastic molding powders into finished parts, and is used almost exclusively on thermosetting materials. The process is distinct from other molding methods in that the granulated or macerated molding compound is placed directly into the mold cavity, subjected to heat and pressure, and held there until the molding cycle or "cure" is complete. During this period a chemical reaction takes place, the molecules grow in size and the material is converted from a fluid plastic condition to a solid infusible molded article.

To speed up molding operations, the powder is often compressed into tablets or preforms which can be inserted in the mold more rapidly and permit more accurate loading. Preheating of the preforms by the use of high-frequency heating units; and infra-red lamps or preheating ovens further speed the process.

Three classes of molds are generally used in compression molding. A hand mold, which is opened, discharged and closed by hand and is operated between heated platens is the most simple and is used for sample or small-lot runs where high mold cost would be prohibitive. Semi-automatic molds are attached to press platens, contain their own heating device and opening, closing and ejecting the part after molding is automatic. Automatic molds, used in automatic presses equipped with cycle control, loading and unloading devices are suitable for rapid production of fairly simple parts. Quality of the molded part produced in this manner is consistently maintained, and few rejections result.

Identification of Methods

Further identification of compression molding is by the basic mold type. The simplest of these is flash-type molding, where an excess of material is placed in the mold cavity and, as it is compressed by the plunger, some of the material flows out of the cavity. This flash or excess material must be removed from the molded article later. Advantages of this type of molding are low mold cost, simplicity of operation and less care required for weighing out material. On the other hand, density and dimension of the molded piece is harder to maintain. Semi-positive molding utilizes a mold which provides a positive land on the cavity against which the force seats. While there is usually a slight fin left on the land, it does not require as much finishing as the product of the flash-type mold. Advantages over the previous method are that less material is used, finishing is reduced, dimensional accuracy is increased and increased molding temperatures are obtained. Fin formation makes it somewhat difficult to maintain uniform density.

In positive type molding no material can escape to form a fin or flash and therefore the cavity is filled only with the exact amount of material required to make the part. Uniform density can be maintained, and dimensions will be accurate. More careful measuring of the charge is required for this type of operation. A widely used type is the landed plunger mold which effects a partial compression of the material and then a positive horizontal cutoff.

Molding Variables

Three variables, pressure, time and temperature, greatly influence compression-molding thermosetting materials. If temperature is too low, viscosity of the material retards its flow and requires excessive pressure and added curing time. If mold temperature is too high, the material is at a moldable viscosity for too short a time and the layers of the piece start to cure before inner layers have been sufficiently softened. If the material is properly preheated before being put in the cavity, a high mold temperature will soften the molding cycle and produce stable parts.

The role of pressure is to force plastic resin into and around filler material, fill the mold effectively and to prevent porosity. An excessive pressure which attempts to force together strata of unevenly heated material will not be as effective as a low molding pressure which becomes active at the point of lowest viscosity of the charge. Proper timing and application of preheat can often avoid the necessity for too low a mold temperature and an unnecessarily long cycle. About 50% less pressure may be required for preheated material. Compression presses in use in the plastics industry are generally classified by:

Operation—Hand molding; manually controlled; semi-automatic and automatic.

Design—Single or multiple platen type; rod type and side-plate type.

Power Source—Hydraulic pressure from a central accumulator; from a self-contained hydraulic pump and from combined hydraulic and mechanical mechanisms.

INJECTION MOLDING

ESSENTIALLY, the injection molding process consists of heating the material (generally a thermoplastic) to a fluid state in the heating chamber or injection cylinder of the press and then forcing it through a nozzle in that cylinder into the sprue channel of the mold, thence through runners and gates into the closed mold. While the shot is being cooled in the mold, the next charge is heating in the injection cylinder. Fast production and low labor costs are important advantages of this process.

The portion of the heater into which the fluid material is forced by the plunger is called the torpedo or spreader and is intended to break up the flow of material. Because of the high temperatures (up to about 550 F.) and pressures, spare heaters should be available. Injection cylinders are usually heated by a series of thermostatically controlled electric coils or by circulation of hot oil or heat-transferring liquid.

In injection molding, the material must be forced into the mold at such a speed that the mold is completely filled before the plastic starts to set through contact with the cooler mold. A partial chilling of the surface before the cavities are filled will cause flow marks and strains, which make a piece more likely to warp under varied atmospheric conditions.

A gravity feed is generally employed to automatically supply the required amount of plastic at every stroke of the injection plunger.

The action of injection molds is usually automatic and the use of removable mold components is held to a minimum to permit the machine to operate at maximum speed, rather than to reduce mold cost. The full hyraulic or ram type of mold-closing device used on many injection molding machines, is comparatively trouble-free and makes mold setting simple. The link-type clamp has a constant stroke over the full range of adjustments and can be used with a wider variety of mold sizes. When these clamps are actuated by a high-speed piston, the molding cycle is shortened appreciably. Both types of molds give good locking performance, and if the molds are properly made and fitted, excess flash arising from locking-device failure is seldom encountered.

Hydraulic pressures used in injection molding will usually vary from 12,000 to 25,000 psi. on the material. Pressure required is dependent on the formula, flow, and size of cavity, as well as the cross-sectional area of the cylinder orifice, sprue, runners and gates and all injection machines have provisions for variable pressure.

Standard injection molding machines have been adapted with relatively few changes to jet molding of thermosetting materials. Temperature of the heater body is held around 200 F. and heat necessary to polymerize thermosetting material is applied at the nozzle by exterior electrodes. This heating cycle at the nozzle is carefully controlled and is intermittently followed by cooling as the mold fills. This keeps the material which is to enter the mold at the next shot at a safe temperature, just below that for curing. Temperature of the mold is held around 330 F. Other arrangements are being used successfully to injection-mold thermosetting material on standard or slightly modified equipment. Positive control of the heat at the heater body and mold, and heating and cooling at the nozzle is mandatory because partial curing of the material ahead of the nozzle and mold would hold up production.

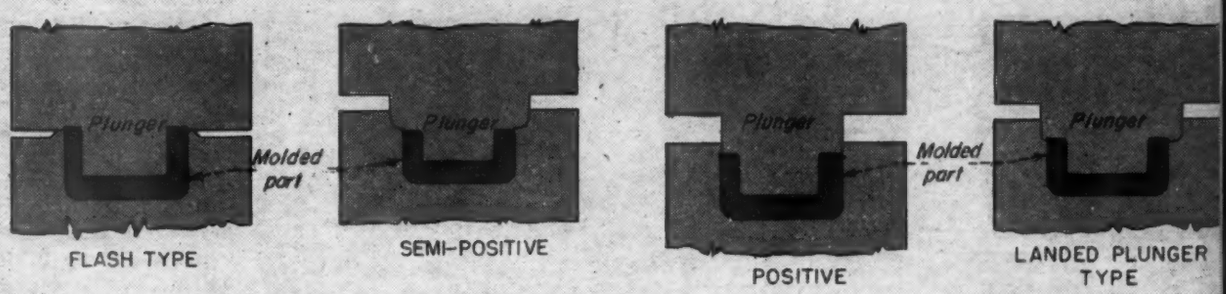
TRANSFER MOLDING

SOME FEATURES of both compression and injection molding are combined in transfer molding, and the process is essentialy an injection molding of thermosetting materials. Greatest value of this process is in producing parts which have delicate and complicated inserts, and which call for mold constructions having fragile projecting sections and long slender core pins which would be crushed or distorted by the unbalanced pressures encountered in conventional closing of the compression mold.

The mold charge is brought to a soft plastic condition by heat and pressure in a chamber or pot, which may be separate from or integral with the mold. The material is then injected into the closed mold cavity through sprues, runners and gates

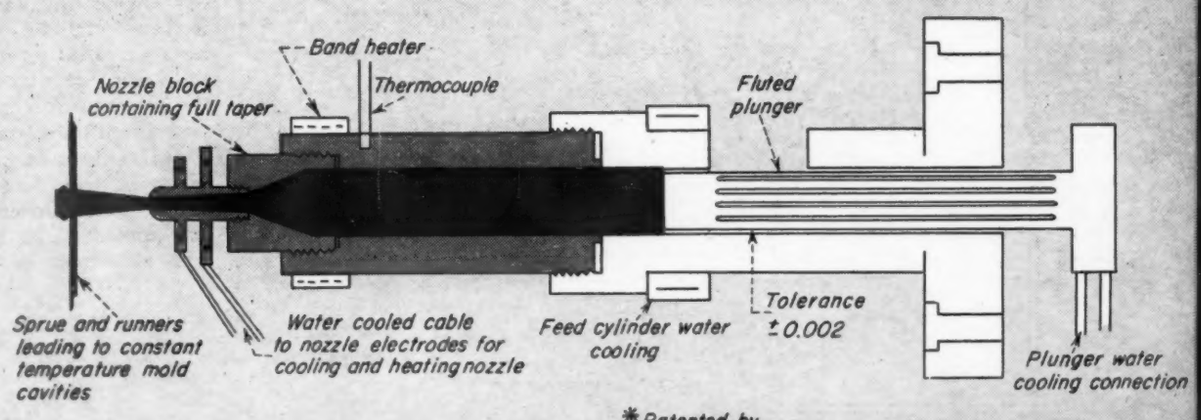
COMPRESSION MOLDING IDENTIFICATION

Seal types as shown provide basic identification of compression molding



JET MOLDING

In injection molding of thermosetting material heat is principally in the nozzle to prevent curing too soon


Band heater
Thermocouple
Nozzle block containing full taper
Fluted plunger
Tolerance ±0.002
Sprue and runners leading to constant temperature mold cavities
Water cooled cable to nozzle electrodes for cooling and heating nozzle
Feed cylinder water cooling
Plunger water cooling connection

*Patented by Plastic Processes Inc.

and heat and pressure maintained until cure is completed.

The transfer molding press is very similar to the conventional compression molding press, except an hydraulic cylinder and ram assembly is mounted on the press head. A center opening (front to back) in the upper grid or bolster permits the operator to drop the preformed molding material into the die sleeve or transfer chamber.

The lower platen of the press is moved upward, forcing the material in the transfer chamber against the plunger. The plunger compresses the material, heat flows from the walls of the transfer chamber and the fluid material is forced through the sprue channel into the heated cavity below, until the cavity is completely filled. Heat and pressure are maintained until the cure is complete, the platen is lowered again and the sprue breaks off at point of contact with the molded piece. An undercut on the plunger withdraws the sprue. The mold is then opened and the molded piece removed by a stripper plate.

CONTINUOUS DRY EXTRUSION

A MACHINE for the continuous extrusion of thermoplastics consists essentially of a feed hopper, heated cylinder and die. Material is fed automatically to the horizontal cylinder, where it is carried along and compressed by a screw and finally forced through a heated die orifice onto the conveying or take-off equipment.

Screws are ordinarily run between 10 and 40 rpm., depending on the formula, flow, rate of extrusion and crosssectional area of the piece. A variable-pitch double leadscrew driven by a variable-speed motor is a versatile medium while a flight pitch decreasing from the feed point to the delivery end compresses the resin. The screw may be bored and fitted for water, oil, steam or an electrical unit. The material for the screw may be high-grade steel, chrome-plated steel or special alloy, depending upon the chemical characteristics of the plastic and its reaction to thermal variables.

Close control of heating is extremely important in extruding any type of material. Many machines have a number of individually controlled heating devices for the cylinder, nozzle and die mechanism. An example of the progressive temperatures required throughout the working length of the equipment puts the temperature at about 150-190 F. at the feed end zone, 240-265 F. at delivery end and head and 310-330 F. in the die and die holder. If the screw runs too hot the extruding rate will drop and tend to stretch the uncooled extrusion. Screw temperatures are usually maintained at the same temperatures as the head, but sometimes run hotter because of friction and pressure. High die temperatures give an improved surface finish.

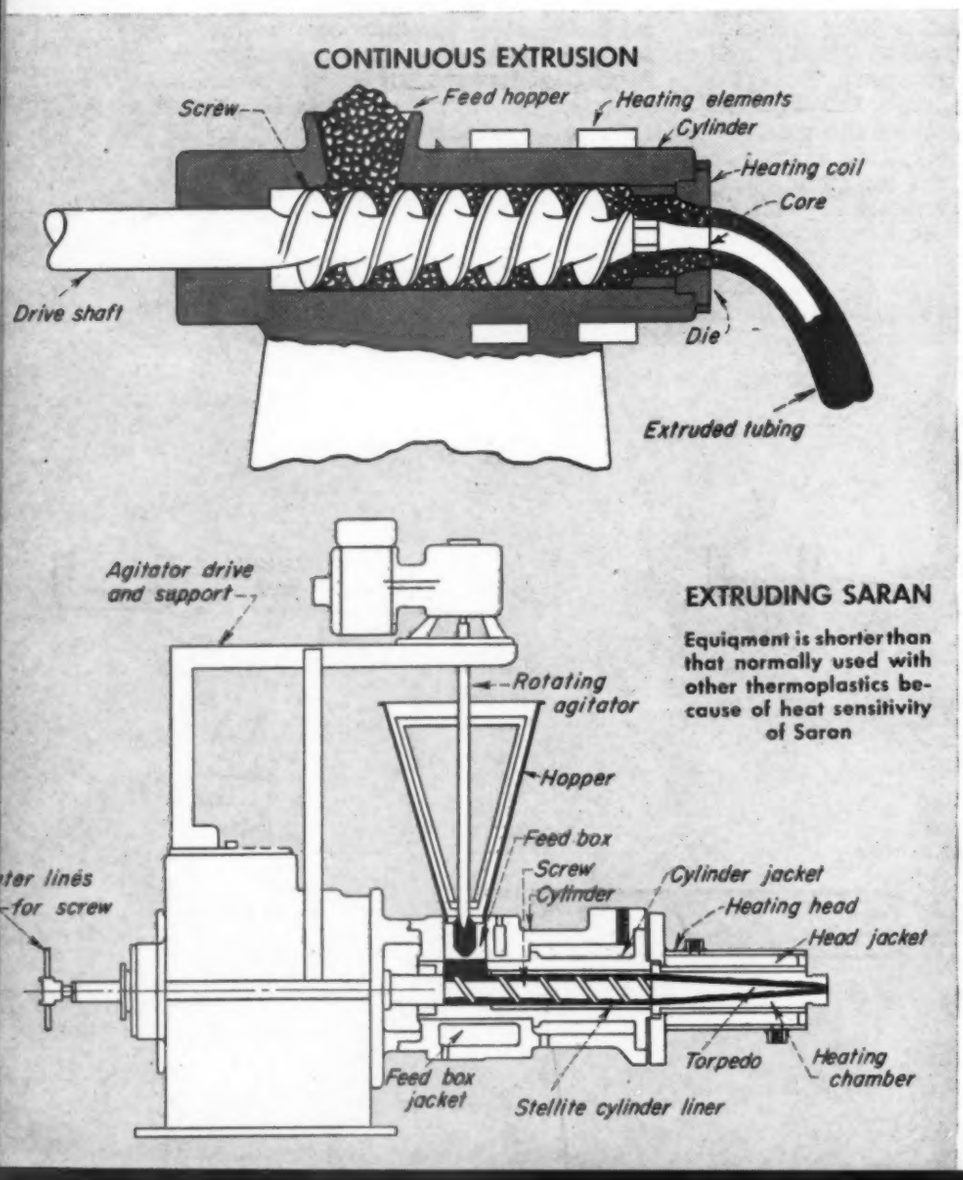
Development of conveying and take-off equipment has broadened the field for extruded products of rigid, non-rigid and thread-like plastics. Endless belts and winding coils are most generally used, running at a slightly higher speed than the material coming from the extruder. They are necessarily long, as the shape cools while on the belt and deformation may easily take place. Rigid extrusions may be cut to length by a knife which is synchronized with extruding speed to cut the material to uniform size. Some of the elastomeric compounds are extruded into water tanks and drawn away by take-off rolls. Variable-speed drives are generally used on take-off equipment for maximum versatility.

Continuous wet extrusion is much the same as dry extrusion, except that much more time and care is required to prepare the materials for the extruder. Machines used are of the hydraulic or screw type.

TRENDS

DEVELOPMENT OF compression- and injection-molding presses and extrusion machines in the next few years will bring about major changes in plastics-processing technique. During the war, shortage of equipment and backlog of orders prevented any radical changes in design.

Heating arrangements on injection presses will be one of the first elements to come in for consideration and at least one press manufacturer has made substantial changes on heating cylinders. With improvements in heating of plastics material will come shorter cycles, lower required pressures and less expensive equipment. Electronic preheating has already resulted in great improvement in compression-molding technique. Extrusion equipment, basically unchanged for a great many years, will also come in for design review.



MOLDS

BASIC TYPES AND MATERIALS

A MOLDED PLASTICS product is no better than the mold from which it is made. This fact has led molders to a closer scrutiny of design of molds, materials for molds, and mold production. Before a mold is specified on a drawing, these should be known:

A. Samples or drawings of the pieces, preferably both. It may be possible to simplify the part or make slight modifications which will lower the cost of production of the mold, increase its life, and facilitate its operation in the press.
B. Estimate of production required.
C. Preferred means of ejection; knockout pins or stripper plate.
D. Type and design of the machine on which the part is to be molded.
E. Platen and hydraulic-cylinder area of the press, as well as line pressure if the part is to be compression-molded.
F. Preferred means of assembly to the press platens — cap screws, clamps or bolts to T-slots.
G. What tolerances are specified, as variations in dimensions may be dependent upon toolroom tolerance in mold construction, wearing of the mold, variation in shrinkage in different batches of the same material and the molding technique.
H. Definite information on the material, as materials have varying shrinkage rates, require different types of gates, runners and heating and cooling channels, and react on metals in varied manners.

TYPES OF MOLDS

COMPRESSION, transfer and injection molds are the three major types of molds for molding plastics, excluding, of course, low-pressure molding, lamination and many other press operations encompassed in the broad plastics industry. Out of these three major classifications come a number of subdivisions and types to accommodate the variety of molding materials and product requirements in this industry.

Characteristics of some of these molds are:

COMPRESSION MOLDS—Cavity receives compound when mold is open and a force or plunger compresses compound as mold closes.

TRANSFER MOLDS — Have built-in chamber or pot, separate from cavities and plungers. Two halves of mold are closed and material enters from pot in plastic state by transfer force. Often the same pressure that transfers material may hold the mold closed. Generally used on thermosetting compounds.

HAND TRANSFER MOLDS—A variation of the transfer mold used for parts with inserts requiring support at both ends.

INJECTION MOLDS—Plastic compound plasticized in injection machine, then flows into mold cavities. Mold halves clamped together while material is injected for the short cooling cycle. Molds are also indicated as hand molds, semi-automatic or automatic, relative to the type of press equipment in which they are used and their independence of action.

Outside the basic types there are molds named because of their construction features as flash molds, landed plunger molds, positive molds and semi-positive molds, which have been described in preceding pages under compression molding.

Special molds have been devised to meet varied requirements, to facilitate operations, lower costs and extend application of plastic materials. A few of these molds are:

SPLIT CAVITY MOLDS—Parts which have projections, undercuts, and side holes can be molded and withdrawn by splitting the cavity in two parts and seating it in a tapered chase or housing. By tapering the ouside walls of the split cavity fin dimensions are held to a minimum and mold wear can be compensated by machining the O.D. of the mold section and seating it deeper in the housing.

REMOVABLE PLATE MOLDS—For parts which have molded threads it is often advisable to use a plate in the molds, which is removed after the mold cycle and the parts screwed off. This is used in both compression and injection molding practice, particularly where multiple cavities or castings are used.

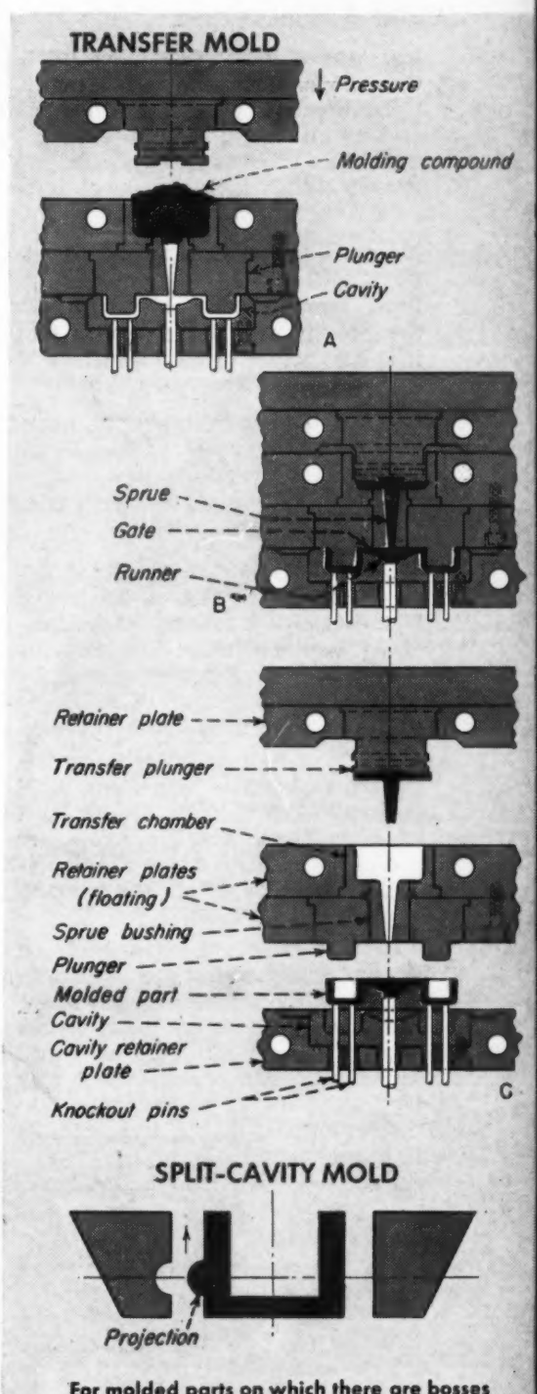
STRIPPER-PLATE MOLD—Used for thin-wall parts where knockout pins might be dangerous as ejectors, particularly in the more elastic thermoplastic parts. The stripper plate moves down, stripping the molded parts from the plunger or punch.

GANG MOLDS—Designed for compression molding of small parts this mold consists of a group of cavities below a common loading area. Material is loaded in this area in sufficient quantity to take care of all cavities and a thin flash connects all parts, enabling the operating to pick the group up as a whole rather than unloading the multiple small cavities. Flash is easily removed in a press fixture which is justified by the high production of the mold.

STANDARD FRAME MOLDS — Standard frames for molds are frequently used to reduce cost, enabling the mold maker to concentrate on the job of producing cavities and looking after plunger details. These frames will handle a variety of requirements and reduce the number of parts required for a mold.

MOLD MATERIALS

INITIAL COST of the steel or metal for a mold is a comparatively small part of the ultimate cost. Selection of the proper material results in longer



For molded parts on which there are bosses or projections, allowing easy removal

production runs, increased safety under long storage, better dimensional stability and lower maintenance cost.

Factors to be considered in selection of mold materials are;

Corrosion characteristics of the plastic.

Molding pressures required.

Finish and area of the mold piece.

Number of parts required.

Storage period between runs.

Mold cost, as justified by the number and quality of parts required.

Although plain carbon steels may be used for short-run or rough-molding requirements, alloy steels are preferred, and should take a mirror polish, show no scum or scale in hardening and hold a polish over long molding runs. Several grades of steel are suitable, including:

ANALYSIS (0.10%C, 0.50% Mg, 0.60% Cr., 1.25% Ni)—A general purpose, low-carbon alloy steel for hobbed cavities in long-run molds that must have more strength and resistance to upsetting than molds made of low-carbon ingot irons.

ANALYSIS (0.15% C, 0.50% Mg, 0.60% Cr, 1.25% Ni)—A general-purpose, low-carbon alloy, case-hardening, for the same type of service except that it is best suited to machined instead of hobbed cavities.

ANALYSIS (0.10% C, 0.40% Mg, 1.50% Cr, 3.50% Ni)—A high-strength, wear-resistant chrome-nickel alloy steel for large molds and long runs at high pressures.

ANALYSIS (0.90% C, 1.60% Mg, 0.25% Si)—A non-distorting, oil-hardening, high-carbon manganese tool steel especially suited for molds with intricate sections. Especially suited for injection molds because of resistance to deformation under high pressure.

Resulting core hardness is an important criterion in selecting a mold material when uniform density must be maintained. Smaller molds are sometimes made of hot-rolled annealed bar stock, while larger molds are made of forgings.

Cost of mold upkeep depends on the molding pressures the mold must withstand, the corrosive action of the plastic, abrasive action of the plastic, whether or not the mold contained thin inserts, bosses or ribs which may break, the design of the mold and susceptibility of the mold to accidents in the press.

One of the most important requirements of a good alloy mold steel is cleanliness. Steels which have been electric-furnace melted and given an inspection, preferably a 100% acid-disk inspection, should provide the essential cleanliness and uniform response to polishing.

The compressing of the viscous plastic in a mold exerts very heavy lateral stresses, sometimes as high as 30,000 psi. If pins or inserts are used in the mold under these conditions, the steel should have exceptional toughness chracteristic of some grades of drill rod.

Application of stainless steel to plastic molds is growing. One of the primary reasons is the protection afforded against corrosion as well as strength. The stainless steels will harden with practically no core and reach tensile strengths as high as 180,000 psi or more. To date this need has been most strongly felt in connection with injection molding where a number of the compounds used have a decidely corrosive action. Rapid cycles and high pressures of the process impose added wear and stress on molds which can be offset by stainless properties.

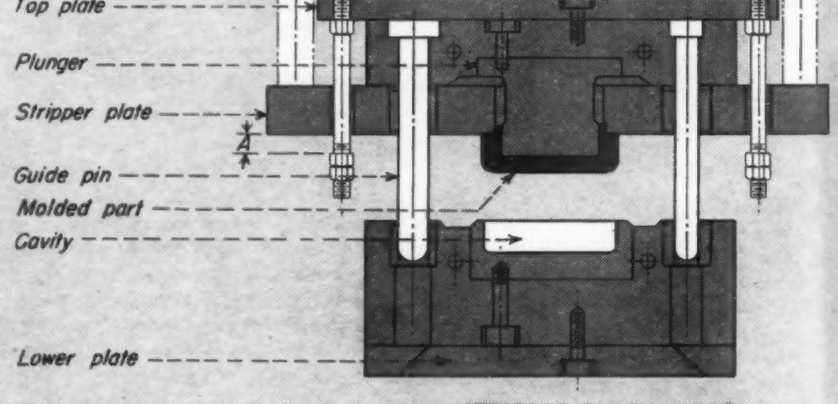
Stainless steels generally used for mold work are the 410, 420 and 440 types. Molds that require higher hardness are generally made of type 440. The most frequently used type is the 420. Type 410 is used where extra dimensional accuracy or easier machining is required at lowest cost. Experiments with free-machining grades of stainless indicate that they are not, at this time, suitable for mold making because of their high sulphur or selenium content.

Non-ferrous materials have been used for short-run jobs, sample runs and intricate designs. Beryllium-copper, of 2 to 3% beryllium content, either pressure or sand cast has been successfully used. It offers low mold cost, and although it does not have the hardness of steel it is hardened uniformly throughout the metal. Generally the higher the beryllium content the lower is its temperature resistance. Additions of other alloys considerably extend the hardening curve so cast alloys can be used at slightly higher temperature than wrought alloys. Pressure casting is being most successfully applied to beryllium copper alloys at the present time. The beryllium copper is cast around a hob in some instances in what is almost a combination of pressure casting and hot forging.

Zinc-alloy molds and cavities have been prepared in much the same manner and used for short-run molding. Tombasil bronze has also been used where control of shrinkage has not been of paramount importance.

HOBBING

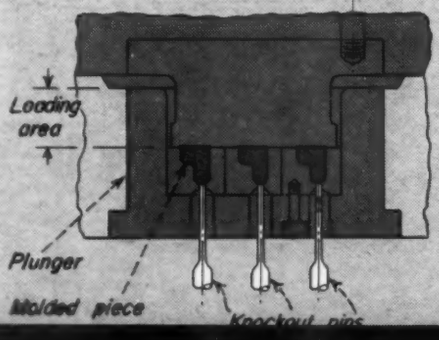
HOBBING of cavities is a widely used method of insuring uniformity and economy in the operation of multiple-



STRIPPER-PLATE MOLD

For use where knockout pins are not advisable. Stripper plate pushes part off the plunger and protects thin walls which might be pierced

GANG MOLD



Useful for multiple-cavity production of small parts, this type of mold often has a hundred or more cavities

cavity molds. It is of particular advantage where volume production of small plastic parts is involved. While designs of hobs vary, general recommendations indicate that there should be as many fillets as possible, no sharp corners, maximum draft or taper, a high polish and no undercuts. Slight undercuts have been made, but are not generally practical.

Hobbing blanks for quality work are usually of annealed steel, ground and polished on the surface which contacts the hob and provided with a relief into which displaced metal can flow. About 60% of the metal that will be displaced in hobbing should be removed for this relief and it is usually in the bottom of the blank.

Blanks should be highly polished before hobbing. The hobbed surface should first be ground and then polished with emery, using No. 150, 220 and 440 papers successively. The surface is buffed, using a cutting compound equivalent to a No. 60-M powdered Carborundum with machine oil. The abrasive should be one that cuts instead of burnishes. On soft metals, it is necessary to guard against tearing the steel with the polishing medium. Such a torn surface has every appearance of pits in the steel and prevents the best possible finish.

When cold-hobbing raised squares in the bottom of cavities, difficulty is often encountered in getting the squares to come up to proper height. The use of a special back punch with projections lined up directly under the raised squares of the cavity forces the metal in the cavity to flow in a direction properly to fill out the raised squares.

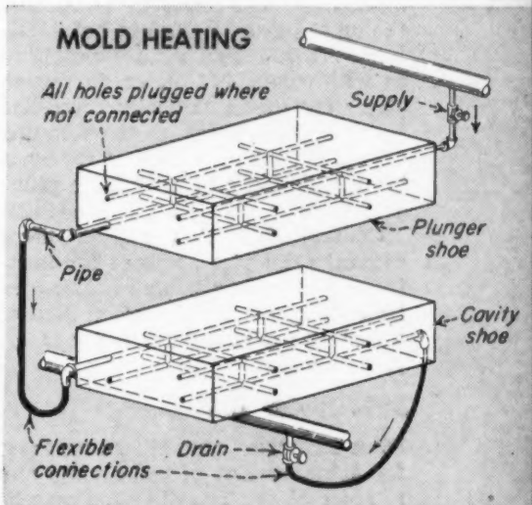
Ordinarily, practice is to hob slowly, but recent experiments have shown that faster hobbing gives deeper cavities up to a certain point. For example, in a number of recent tests, pressures were increased from 90 to 125 tons in a period of 45 sec. as compared with 90 sec. The cavities hobbed at the faster speed were from 0.050 to 0.090 in. deeper.

Pressures for hobbing usually range from 50 to 200 tons per sq. in., and hobbing may proceed in a series of pushes, sometimes alternated with stress relief. Bottom relief is a determining factor in ease and depth of push. Blue vitriol (copper sulphate) is the most generally used lubricant. However, a solution of 15 g. of copper sulphate, 5 g. of oxalic acid in 50 cc. of water is an alternate solution. Another good solution is made by dissolving 300 g. of copper sulphate crystals in 3,000 cc. of water with enough ammonia almost to neutralize the solution. The master hob is inserted in this solution for 5 sec. to obtain most satisfactory coating.

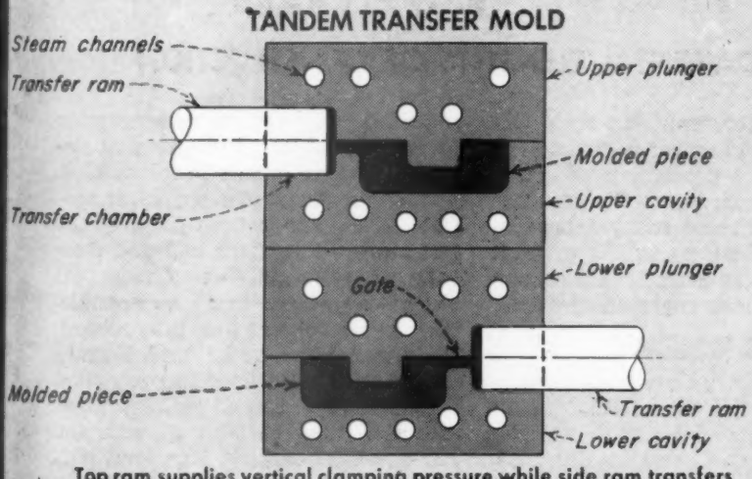
MOLD HEATING

Molds for thermosetting materials may be heated either indirectly from steam plates or by direct coring for steam, water or electrical units. When properly designed either system is satisfactory for the production of all but the largest moldings, the molds for which should be heated by direct coring. Interchangeable steam tables are most practical.

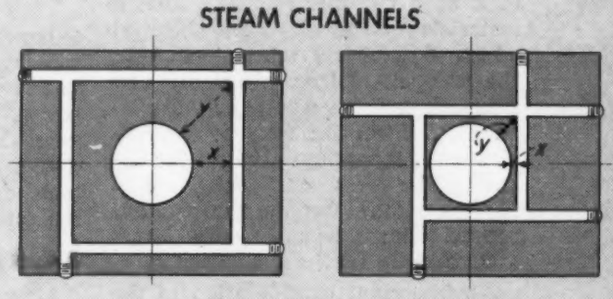
In heating a mold from a steam plate, sufficient steel must be allowed around the cavity so radiations from the thinnest sections of the mold do not cause appreciable inequalities of of temperature. This factor is of



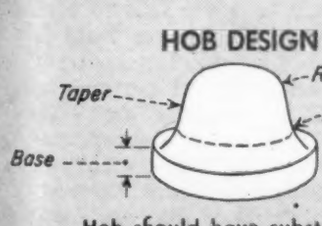
Heating by steam table, lower platen being connected in series with top by flexible hose



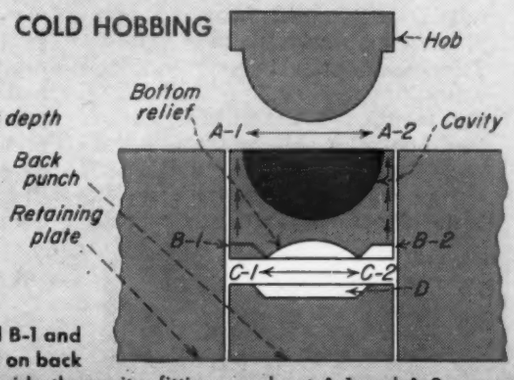
Top ram supplies vertical clamping pressure while side ram transfers plastic molding compound to the required number cavities



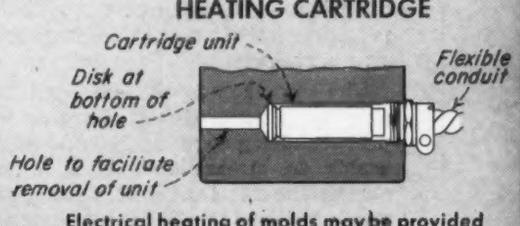
Distance x should be greater than ½y for proper steam channeling, as shown at left, where y is the greatest distance from the channel to the mold cavity



Hob should have substantial radius taper of at least 1" and a relatively strong base.



A back punch pushes metal around B-1 and B-2 while bottom relief is flattened on back punch at D. Metal flow is up alongside the cavity, fitting equally at A-1 and A-2



Electrical heating of molds may be provided by inserting cartridge elements

course qualitative, and its proper relationship to the size of the mold and sections used are a special problem in each case. An improperly designed die may sometimes be improved by lagging with asbestos.

In building molds to be heated by direct steam channelling, sufficient steel should be provided so the channels are not too close to the mold surface. Placing the channels near the outside of the mold, rather than near the cavity, insures a more uniform temperature on the cavity surface. Broadly speaking, the closest distance from channel to cavity should be under half the greatest distance.

Cartridge-type heating units may be used to heat molds by electricity, the units being inserted in holes, following much the same precautions as with steam, hot oil or hot water. These are thermostatically controlled for required changes in temperature. Calrod heaters are also used for heating molds. Long or very large plungers may be heated independently.

Cooling of molds follow the same general principles as those for heating and must be capable of close control. Compressed air is often used as a cooling medium, particularly in injection molds.

EXTRUSION DIES

MOST EXTRUSION DIES, other than those for tubes, consist of a die plate and retainer block. The die plate may be made in one piece or in a number of segments to facilitate machining, and should be a light press fit in the retainer block. Tool steel is widely used as a die material. For certain materials such as vinylidene chloride, which decomposes when heated in the presence of iron, nickel alloy or magnesium makes a more suitable die material. Steel dies may be chrome-plated for maximum abrasion resistance. The dies are usually not hardened until after the trial run has proved them to be satisfactory. Brass is frequently used for die-plates.

An important consideration in the construction of dies is the length and finish of the land, or the straight section through which the material last passes before emerging. It should have a mirror finish and just be long enough to secure the necessary back pressure, finish and eliminate excessive shrinkage.

The approach to the die from the extruding head should be free of pockets, sharp edges and should preferably be streamlined. If it is too abrupt the material will be trapped and if too gradual the die may restrict the compound flow and lower output.

In general, the dimensions of the orifice are the same as, or up to 25% larger than the shape to be made. To attain uniform velocity and maintain cross-sectional areas, land modifications must invariably be made after the trial run and speed of the take-off belt regulated. As an example, in extruding a rectangular strip it would be found to be thicker at the center than at the sides. To correct this condition, the length of land should be reduced at the sides, thus lowering resistance to flow and providing a uniform flow across the entire cross-section. Similarly, in extruding an L-shaped counteredged strip, where one edge is much heavier than the other, the length of lip on the die forming the thin edge should be shorter to obtain uniformity. For best results the die is provided with an independent heating arrangement, such as a strip heater covered with asbestos, which eliminates sticking of the material when starting the job.

Corrections can be designed into the die by using a fixed ratio of land to cross-sectional thickness. Ratios run anywhere from 2/1 to 16/1, depending upon the material being extruded. Once a ratio has been determined for a particular die and shape, it should be followed closely in making new dies, if the compound is of constant formula.

In a fixed-type die for extruding tubing, the core forming the inside of the tube is fitted in the block which is bored to form the outside of the tube. This type of die is used where concentricity and wall thickness need not be held to close tolerances. Where accurate dimensions are desired, the adjustable type is used. In this type, the core forming the inside of the tube is in a fixed position in relation to the main parts of the die, but the shouldered ring, bored to form the outside of the tubing, can be adjusted by means of setscrews.

CHROME PLATING

A PROPERLY PLATED MOLD cavity will maintain its polished surface longer than one which has not been chrome-plated. It also helps eliminate sticking of the plastic to the cavity and prevents discoloration of both mold and product by heat. If the cavity contains sharp reentrant angles or sharp corners chrome plating may cause trouble through peeling and flaking. Added protection against gases released in molding is provided.

Cavities that are to be chrome-plated should, after heat-treatment, be cleaned carefully and highly polished, as any minor defects will be reproduced in the plating. After chrome-plating the cavities should be baked at temperatures of about 300 F. to eliminate any acid brittleness.

MOLD DESIGN

FUNDAMENTAL ELEMENTS OF CONSTRUCTION

CLOSEST COOPERATION between designer and mold maker is essential to the economical production of sound molds. Experience over the past few years has indicated many taboos in design of molded parts. As a result mold design has been facilitated and put on a sounder engineering basis.

COMPRESSION MOLDS

ON PERPENDICULAR DIMENSIONS, tolerances of plus or minus 0.002 in. in the part are the minimum that can be satisfactorily and economically held, while plus or minus 0.005 in. is more workable. Shrinking tolerances are usually determined from data supplied by the materials manufacturer. Tolerances for male parts are calculated by adding 3/4 of the total plus tolerance to the basic dimensions and then adding the material shrinkage. For female parts, subtract 3/4 of the negative tolerance from the basic dimension and add material shrinkage, thus making compensation for the variables. End use will determine degree of care in tolerancing.

Guide or dowel pins should, if possible, be on the bottom plate of the mold, preventing flash and dirt from entering guide-pin holes. Guide pins are placed as far apart as possible, and where plates are unhardened, guide bushings may be used. Diameters of guide pins vary in proportion to size and weight and molding pressure and have a sliding fit with the guide hole or bushing. Knockout pins eject the molded part from the cavity or plunger and it is safer practice to use too many than too few, to prevent distortion. Usually the mold is designed so that the knockout-pin marks are on a part of the molded product which does not show. In some cases, the knockout pins may produce trademarks and other essential specifications on the molded part. Two general types of pins are used,

peened-head and turned-head. The latter is preferred for pins over ½ in. in diam. and are supplied with a center in the head for machining convenience. Some of them have an undercut just below the head. Insert pins are also used to produce holes in the molded piece.

An important consideration is to provide for easy removal of the part from the mold by providing the proper allowance of inside and outside draft or taper and polishing the molds to a high luster. The wedging action due to these tapers increases the density of the plastic, particularly desirable in deep drawn parts. For the average part it is well to allow a taper of 0.010 to 0.017 in. If this allowance results in too pronounced a taper in deep-drawn parts, it may be reduced somewhat.

One way to strengthen molded parts is to provide generous and well rounded corners or fillets. They strengthen the mold and save wear on the plunger.

Flash Line Location

The attractiveness of a product depends partly on careful location of the flash line where excess material is squeezed out between halves of the mold and when located improperly the flash cannot be removed without marring the molded part. The flash line is usually located at the maximum diameter or area of the part on a single plane. A narrow land is to be preferred and increases the chance of holding flash to a minimum and the component parts are guaranteed a better fit. When flash does not exceed 0.003 in. in thickness, as on parts produced in flash or semi-positive molds, it may be easily removed in tumbling barrels or on a bench lathe or grinder. It is well to note that pressure on the material is not always determined by available press capacity, but by the completeness with which it is sealed off from escape.

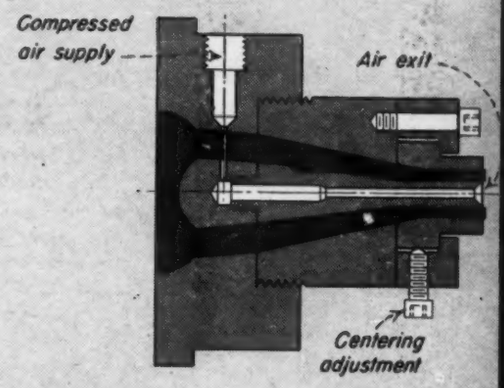
Through holes may be molded with a single pin supported at both ends or by two pins butted together. One pin should be slightly larger than the other to allow for minor misalignments during molding. Ends must be ground flat and the resultant thin flash is easily removed. For blind holes the length of the core pin can be safely calculated as twice the diameter. When a hole is 1/16 in. or less in diameter, its length should not exceed its diameter. Wall thickness between holes should not be less than 3/32 in. and the outside section around any hole should be a minimum of half the diameter of the hole. Side or oblique holes are difficult to mold by the compression method and pins may be easily removed if transfer molding is used.

Bosses are used to reinforce holes and inserts and also to reduce thickness of sections. They should be provided with adequate tapers for easy removal of the plastic part. Bosses on external sections should project at least 1/64 in. so that they may be easily sanded flat.

When properly designed a metal insert has an adequate land surface to take the assembly pressure and to prevent the insert being dislodged. Inserts with internal threads should not be placed flush with the surface of the molded part, for during the molding operation the plastic may flow into the threads, which must then be cleaned out by tapping. This can be prevented by providing a recess around the top of the insert or by extending the end of the insert above the surface of the plastic.

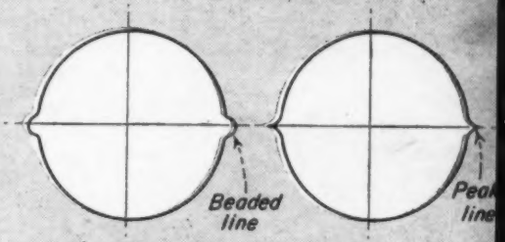
With a flash-type mold, it is preferable to use an overload of material, dense preforms preferably preheated and a slow closing of the mold, allowing the compound to thoroughly

EXTRUDING TUBING



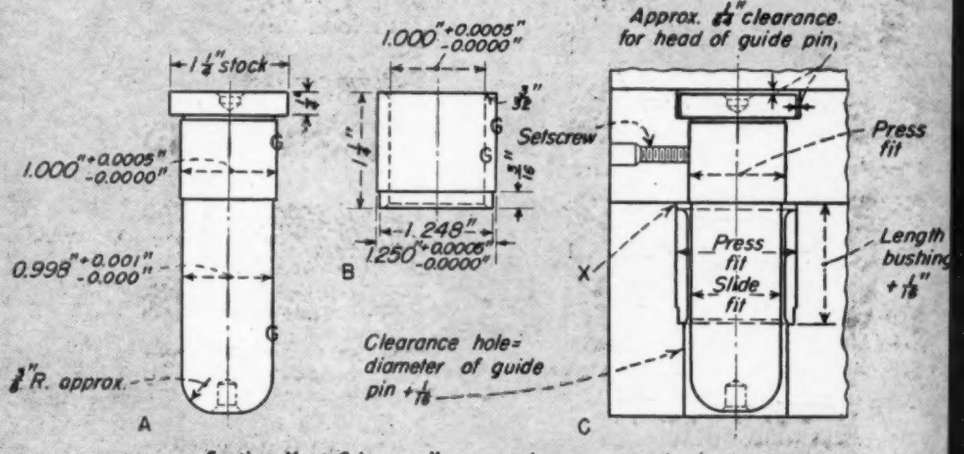
Compressed air fed through die orifice cools and prevents collapse of plastic tubing as it leaves heated die at high speed

PARTING LINES



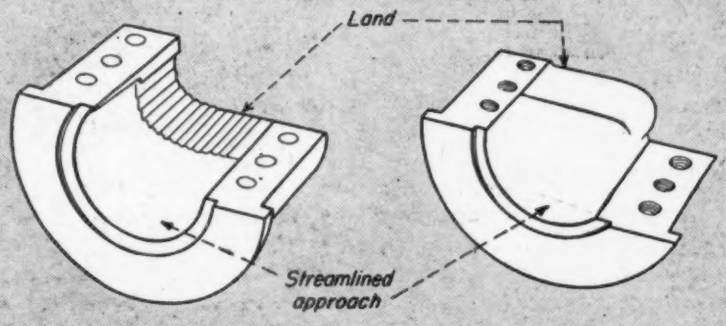
Preferred types of parting lines in molded pieces leave a regular and minimum amount for finishing operations

GUIDE PIN TOLERANCES



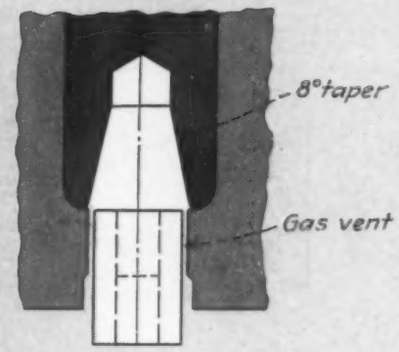
Section X at C is usually peened to prevent the bushing from being pulled out when mold opens

EXTRUSION DIE APPROACH



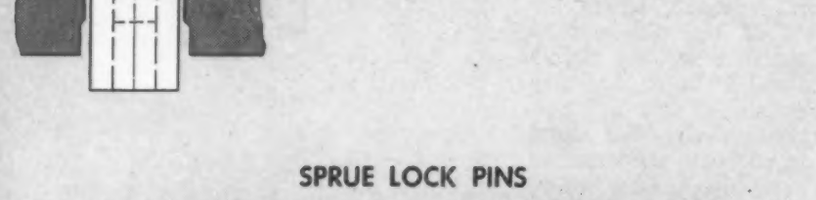
A streamlined approach and land provides most favorable entrance and departure for extruded material

VENTING



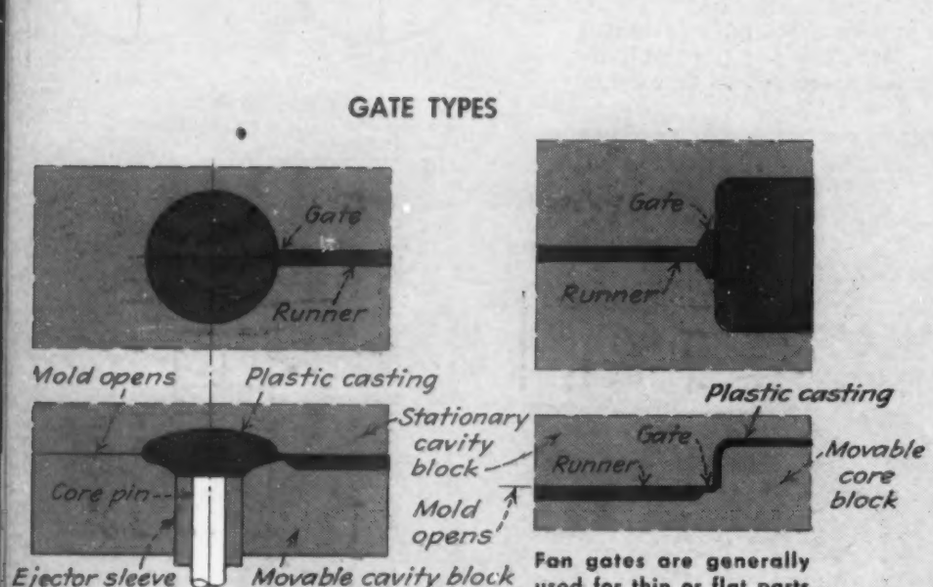
Gas vents may be applied to mold or knockout pins, preventing unnecessary marks on molded pieces

SPRUE LOCK PINS



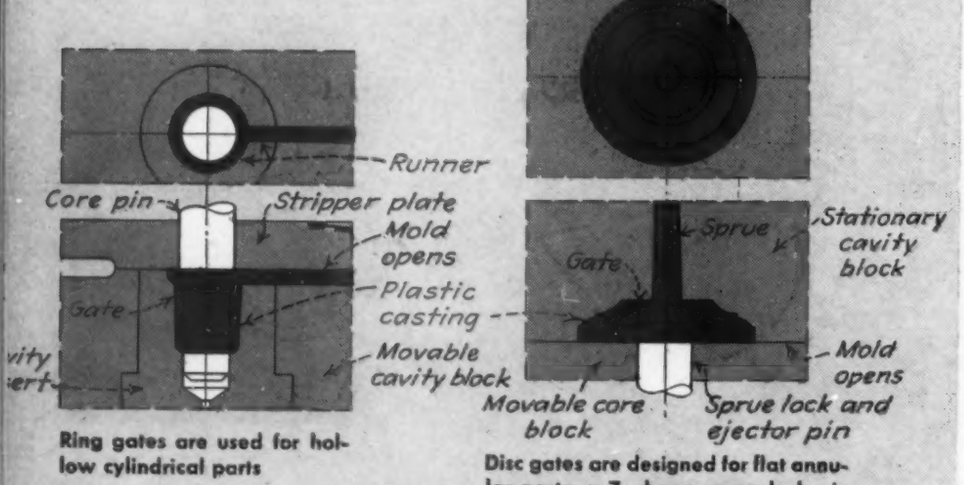
A hook allows the Z-type pin, fastened to the ejector mechanism, to pull the plastic sprue from the mold

GATE TYPES



Standard gates are used for average molded parts

Fan gates are generally used for thin or flat parts



Ring gates are used for hollow cylindrical parts

Disc gates are designed for flat annular parts, a Z-shape sprue lock pin pulling the sprue as mold opens

heat and partially harden before final closing. As a variation of this method, the press may be held on low pressure for a few seconds when the mold comes together, before applying high pressure.

Multiple-cavity positive molds are not usually recommended. When the fit between the plunger and the cavity is made loose to allow overflow, or sprue grooves are added and external press stops employed to determine the depth of cavity, maintenance of pressure on the compound becomes difficult if not impossible.

On positive or land-type positive molds, it is necessary to provide sprue or escape grooves. These grooves should be designed so that a shot of air would clean out the flash without poking with the point of the air nozzle or chipping tool. This prevents the sprue from remaining in the cavity, and in the case of multiple grooves eliminates rejects and many light pieces in the production run.

TRANSFER MOLDS

CAVITIES, plungers and removing mechanism are similar to those for flash molds, but a transfer chamber and sprue, runners and gates must be provided. Where only one sprue is used, it should be located as near as possible to the center of the transfer chamber. Clearance between the transfer chamber and plunger should be as small as possible for maximum operating efficiency, avoiding at the same time any scoring of the chamber wall. Clearances of the order of 0.001 to 0.003 in. a side are satisfactory depending on the area of the chamber. A small radius may be maintained at the bottom of the chamber for easier removal of material.

Sprues should be located in such a manner that the shortest possible runners may be used to lower resistance to compound flow. Runners may be tapered from 20 to 30% to expedite release of parts. As many chambers, sprues and runners may be used as required and the process lends itself to multiple cavity molding from an individual charge.

Like injection molds, transfer molds must be vented to allow trapped air to escape. This vent, large enough to allow a slight transfer of air is too small to allow any appreciable amount of material to escape. It should be placed with proper concern for other functioning parts and channels and in a more inconspicuous part of the product if possible, or where it can be easily removed in finishing of the part.

INJECTION MOLDS

AN INJECTION MOLD consists of two major parts, the stationary part of the mold being fastened to the stationary platen of the machine and in operation directly contacting the nozzle in the end of the injection cylinder. The movable part of the mold is fastened to the movable platen of the machine and ordinarily houses the ejector mechanism. Each of these parts has a face, which is lapped and ground to avoid flash.

A balanced mold, one with the cavities arranged symmetrically with respect to the sprue, giving an even distribution of flow, is the best design. Should the shape or size of pieces to be molded be such that a balanced mold is not feasible, the land should be symmetrical to minimize strain on the machine.

Guide Pin Location

Two or more guide pins must be provided for lining up the mold, especially when locating it in the machine, and should be press-fitted in the stationary part of the machine. This arrangement gives better clearance for ejection of the molded pieces. Pins should be longer than the longest core to enter the guide hole before the core enters the cavity.

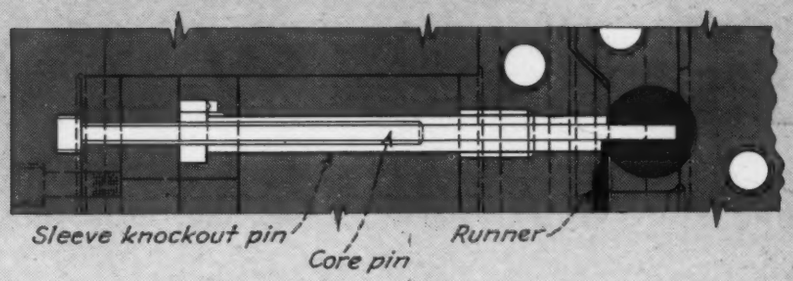
Cavities of an injection mold can be machined in the mold proper or each cavity can be located in a hardened-steel insert fitted in the mold blocks. Cavities forming the outside of the molded part are best located in the stationary part of the mold, because molded pieces tend to shrink clear of a cavity and cling to a core.

Mold blocks are made of wrought steel. Channels for cooling are generally drilled holes, and a proper placement of them to secure uniform cooling of the cavities is desirable.

The sprue hole, or mold entrance, is a tapered polished channel through the stationary part of the mold and directly in line with the injection cylinder orifice. The small end of the taper, which is from 2.5 to 4%, is toward the nozzle and about 1/32 in. larger in diam. than the orifice to facilitate pulling the sprue. The sprue should be centrally located in a hardened steel bushing, press-fitted into the stationary part of the mold and having a shoulder to prevent the bushing from bearing on the moving part of the mold. This bushing also provides a cup-shaped seat for the nozzle of the injection cylinder.

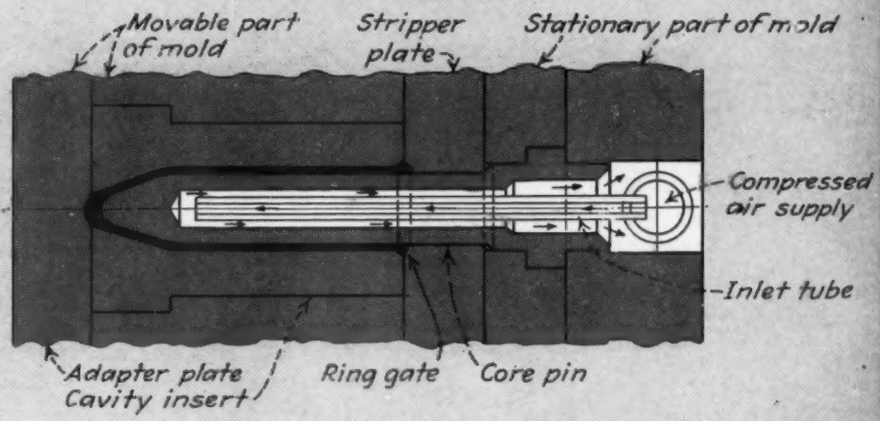
Runners, which lead from the sprue to the individual cavities, should in most cases be in the ejector

SLEEVE KNOCKOUT



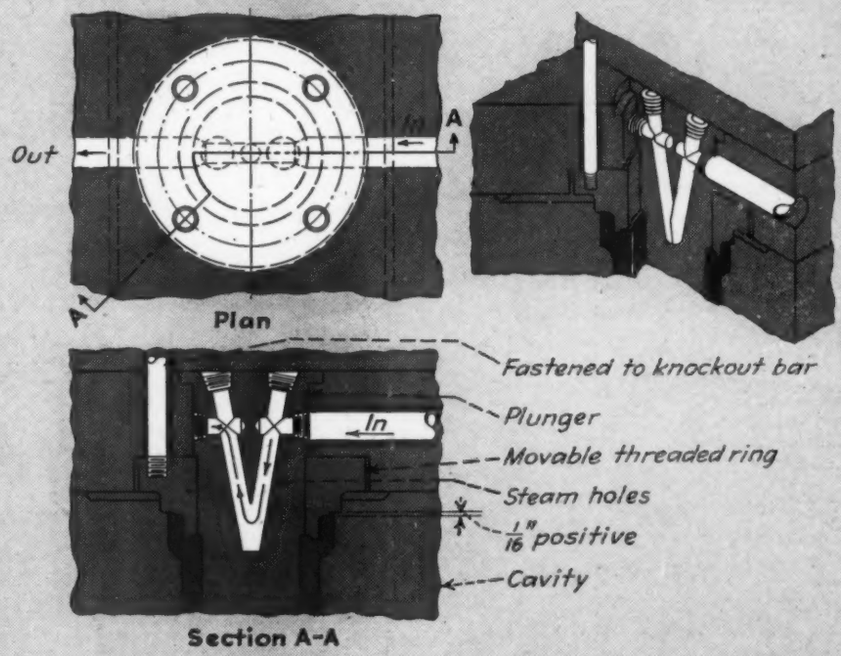
Sleeve type pins may operate over a core pin for rapid ejection

CORE PIN COOLING



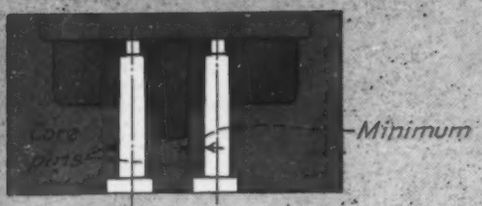
Compressed air passed through a small tube, expanding into a larger hole in the core pin is an effective cooling medium

CORE WITHDRAWAL



A movable thread ring attached to the knockout bar allows withdrawal of cores before unscrewing parts from the mold

MOLDED HOLES

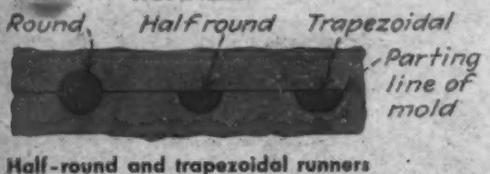


Minimum dimensions between ribs and holes should generally be about 1/2 in. for safety

WALL THICKNESS

Cross section at the bottom of part should be slightly larger to guarantee full density in top walls. Taper of 0.010 to 0.017 in. is good practice

RUNNERS



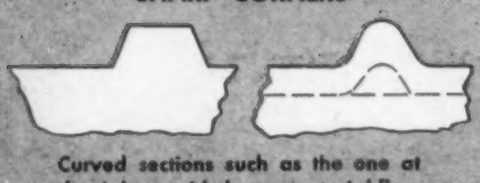
Half-round and trapezoidal runners are machined on one side of mold

SPRUE BUSHINGS

Conventional bushing with slightly enlarged taper gives even flow

A sprue bushing suitable for transfer molding has a minimum wall thickness of 3/8 in. and is set in below the transfer pot in standard practice

SHARP CORNERS



Curved sections such as the one at the right provide better material flow than sharp corners

half of the mold. They should be highly polished in direction of flow and as short and direct as possible as pressure drop in runners is proportional to the square of the increase in length. The main runner area should be equal to the sum of all avenues stemming from it. Circular runners are best and provide minimum resistance to flow, but modified runner cross-sections such as half-round or trapezoidal are used.

Successful injection molding is largely a function of proper mold gating. The gate is the restricted part of the runner at the point where it joins the cavity, and the molded piece is separated from the sprue scrap more easily if the gate is shallow. Although pressure on the material, the temperature of the material and the temperature of the mold are factors to be considered a good practice is to start with a gate approximately 0.025 in. in depth and then, with varying pressure and temperature gradually increase the depth of the gate until a perfect casting is obtained.

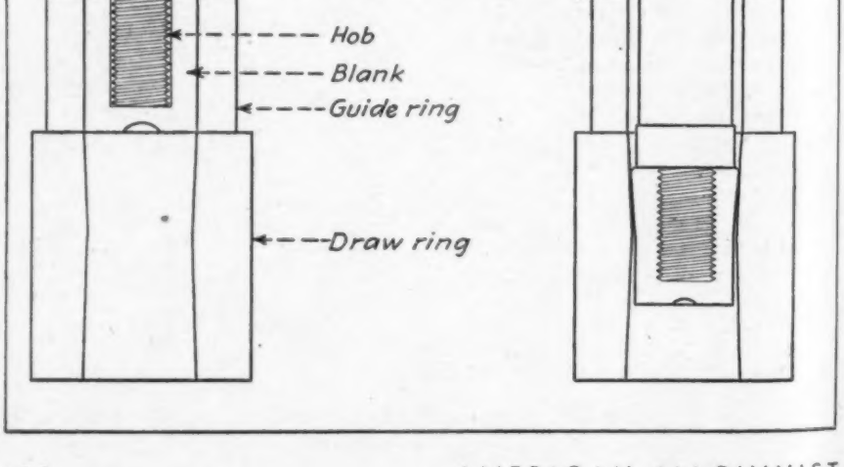
Of the types of gates, the standard gate is used where there is a multiplicity of small cavities and for reduction of finishing operations. A fan-type gate is used for thin, flat pieces of large area to spread the material and minimize flow resistance. A ring gate is used for molding hollow cylindrical pieces. The material enters the cavity around the core pins and flows down evenly around the pins preventing air from being trapped. A disk gate is most advantageously used for flat annular pieces, the sprue hole leading directly to a disk which causes the material to flow evenly from the center into the cavity, eliminating a weld. It is the opposite of a ring gate where the material flows in from a periphery.

When injection is made around variously shaped cores or inserts, a better weld is sometimes effected at the point farthest removed from the gate by venting at that point. Vents can be located at junction points of the streams of material or at weld lines. These vents facilitate escape of air, which if trapped, would prevent filling the cavity. Where no other effective means of venting is convenient a small hole, not more than 0.025 in. is drilled in the cavity, serving a much larger hole in the mold block as an outlet. The hole should taper away from the cavity.

Removing Parts

Removal of castings from the mold is generally accomplished by travel of the mold when opening. Three methods are in general use; ejection by pins; stripping from cores by means of sleeves around core pins or by a stripper plate. An ejector mechanism is usually housed in the movable or body part of the mold and is actuated by the opening or backward travel of that part. Ejector pins or stripping sleeves are located by and fastened to the ejector mechanism. The ends of these pins or sleeves comes in direct contact with the molded piece, and the movement of the ejector mechanism forces the molded pieces from the cavities or off core pins.

In draw-hobbing, hob is inserted in hob blank, backed up by pressure ring inserted in guide ring and forced through tapered draw ring. Limited plastic flow of the metal and high compressive forces permit hobbing of work hardening steels.



MACHINING

STANDARD MACHINE TOOLS, SPECIAL TOOLING

MACHINING OF PLASTICS may be accomplished on standard equipment, but certain modifications in tooling are required. For most plastics, speeds, feeds and depth of cut are somewhat similar to brass and copper practice. The lower shear strength of these materials permits high cutting speeds and feeds, while the greater resiliency calls for increased clearance and less rake on cutting tools.

Varying physical and chemical properties of thermoplastics, thermosetting materials, cast resins and laminates indicate moderate revisions in tooling. In general, properties of plastics affecting machinability are:

Low heat conductivity—making it necessary to cut down generated heat or provide for its rapid removal to protect tool and product.

Comparative softness — requiring tools which will remove chips faster than those used in machining metal.

Abrasiveness — presence of inert base materials in laminates and some molded materials dulls tools more rapidly than steel, suggesting nitrided or carbide-tipped tools for some production operations.

DRILLING

THE IMPORTANT considerations in drilling plastics are drill design, operating speeds and drill lubrication. For best results, a twist drill of special design, with wide, highly polished flutes and maximum chip clearance, is recommended. A slow helix is suggested for through holes and a fast helix for blind holes. In drilling laminated stock, all of the cleared portion of the land is removed to give the greatest amount of chip clearance possible. The point of the drill should be dulled to prevent work from climbing on the drill.

A small helix angle of approximately 17°, particularly on cellulose acetate and nitrate, provides a rapid escape for the chips and minimizes heating of the piece. A clearance angle of approximately 40° will remove enough material to allow the chips to flow freely into the flutes. Small point angles give good results but are undesirable for blind holes. Points as low as 60° may be used on thin material and tubing to prevent chipping and grabbing. However a 90° point is considered good standard practice.

As laminated material shrinks somewhat after the drill is removed, it is necessary to drill about 0.002 to 0.004 in. oversize or to ream the hole to the size required. This is reduced to a minimum when drilling glass-base material. For drilling holes ¼ in. and larger in glass- and asbestos-base material, drills which have been designed for cutting metal and which have been tipped with carbide are recommended.

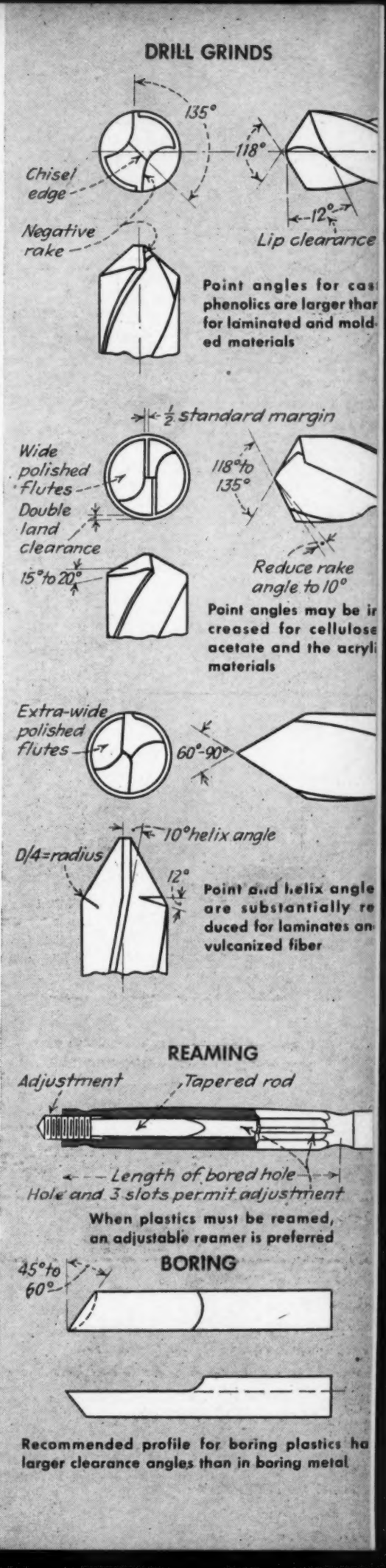
DRILLING SPEEDS

SPEEDS as high as 300-350 fpm. are possible in most plastics if tools are kept sharp and heat generation is closely checked. Lower speeds are used for glass-base laminates, polystyrene and methyl methacrylate. Feeds should be fast but not forced, and on deephole drilling the drill should be backed out frequently to cool the piece and clear the chips.

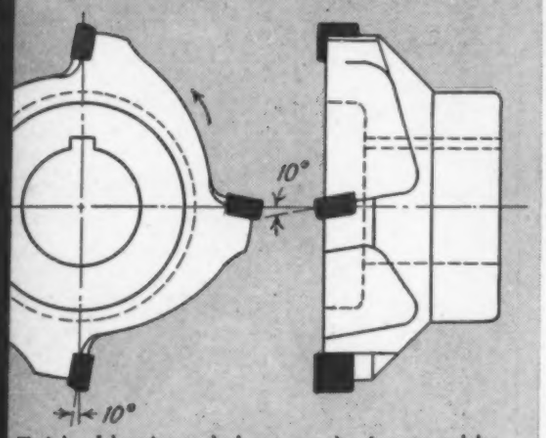
Most materials can be drilled without lubricant, although compressed air provides an ideal coolant for higher speeds and keeps the work clear. A flood of water will decrease both dust and heat during drilling of glass-base materials. For small-lot drilling, the drill may be lubricated by passing it through a piece of soap every four or five strokes. With higher cutting speeds on cellulose acetates, a soluble oil may be used.

Among the special drills which may be used is the "bobbin" bit, which has but one large flute and provides rapid removal of chips. Counterboring and countersinking up to 5-in. diam. may be carried out at 200 fpm., and feed is generally by hand. Initial contact between tool and work should be light in order to break the highly polished surface without cracking. If chattering occurs, a slower speed may remedy the condition. Flycutting is generally employed to cut disks or large holes not practical for drilling, at a speed of about 400 fpm. Flycutters should be tipped with cemented carbide where high production is required. Two blades are generally used instead of a single blade.

In drilling parallel to laminations, the material should always be clamped in a vise or between plates. When drilling perpendicular to the laminations this is not necessary, but the material should be backed with a tightly clamped support of wood or metal until the drill has passed completely through.

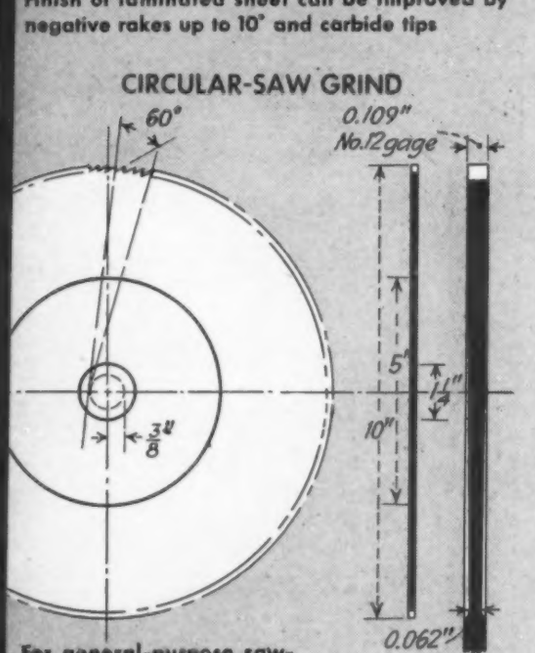


MILLING-CUTTER GRIND



Finish of laminated sheet can be improved by negative rakes up to 10° and carbide tips

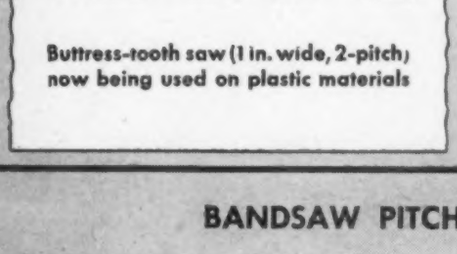
CIRCULAR-SAW GRIND



For general-purpose sawing of laminated stock

Enlarged Cross Section

BANDSAWING



Buttress-tooth saw (1 in. wide, 2-pitch) now being used on plastic materials

TURNING

LAMINATES with a fabric base can generally be worked with high-speed steel, but carbide-tipped tools are preferred for paper-, graphite-, asbestos- and glass-base plastic. These may be ground with a 33° clearance angle, no back slope or lip and with a side slope of 13°. Female centers are better than male centers in turning laminated stock as the male center separates the laminations.

In both facing and turning, the tool should be set so the heel of the cutting edge cuts in advance of the point in order to shear in the direction of the stock being removed. If the point is set in advance of the heel of the cutting edge, it will tend to peel off the stock and throw up a fin or a burr. Tools for threading or forming should be ground with 0° to 10° clearance.

Turning tools for cast phenolics are given zero or slightly negative back rake and 15° to 18° relief and should be set about 2° above center. Cutting edges should be in condition to produce long ribbon shavings. Generally, high speeds of 700 to 900 fpm. and light feeds are desirable. Most work is done dry, although a non-alkaline coolant may be used. In general fabrication practice light-duty lathes are suggested. Tools are generally set at an angle of 60° to the spindle.

Turning speeds for glass- and asbestos-base laminates, using carbide tools, are approximately 400 fpm. and almost double this for fabric-base materials. Feed may be approximately 0.010 in. but is finally determined by the quality of finish desired.

SCREW-MACHINE WORK

MOST SCREW-MACHINE operations on laminated stock are performed dry, but for deep-hole drilling and threading a coolant, consisting of 60% paraffin oil and 40% kerosene, can be used. Internal and external threading is done with standard tooling. Chasers should have a 33° chamfer on the lead and a negative rake up to 10°. Forming and undercutting can be successfully performed, but care must be taken that an extremely fine feed is used, preferably not over 0.0005 to 0.001 in. Circular and form tools can be used for forming, but should not be greater in width than 75% of stock diameter. Tools are ground approximately the same as for brass, with slightly greater clearances. Speeds for hand screw machines are approximately 3000 rpm. and for automatic screw machines about 6000 rpm. When cellulose acetate is scheduled for screw-machine operation, it should be allowed to remain at 70 F. for 24 hr. before being machined.

TAPPING

FOR TAPPING and threading laminates, high-speed nitrided and chromium-plated taps give good results. Three-fluted or two-fluted gun taps are recommended. A negative rake of 5° on the front face of the land will help prevent binding and stripping of the thread when the tap is backed out. Taps should be about 0.002 to 0.006 in. oversize, as there is a tendency for the material to close up when the tap is removed. To prevent splitting, laminates must be clamped when tapping parallel with the lamination. Edges of the holes should be chamfered and supported.

Holes to be tapped should be larger than is customary for metal in order to leave about 75% of a full thread. This will prevent the top of the thread from breaking or peeling off and give a cleaner job. If tapping is done in a machine, a speed of 40 to 50 fpm. is satisfactory. Water is a good tapping medium and dries off quickly. Threads can be chased in a lathe on solid stock but have a tendency to peel or break off in laminated material. When V threads are chased, the lathe compound should be thrown around to 30° and the tool ground to cut on one side only.

It is possible to tap the acrylics satisfactorily for standard thread forms but threads for mounting or attaching where stress or vibration is likely to be encountered are not recommended. Where threading is necessary the coarse-pitch threads are preferred. Tapping speeds for this material are about 20% slower than for most other types. In hand-tapping small holes 3/16 in. or less in diameter it is not necessary to use a lubricant, but for larger holes a mild soap solution is suggested. For machine tapping, work should be flooded with this coolant.

BANDSAW PITCHES AND SPEEDS

Material / Work Thickness, in.	Saw Pitch				Saw Velocity, fpm.			
	½	2	4	6	½	2	4	6
ellulose Acetate (No Filler)	6	4	3	2	4500	4000	3700	3300
ellulose Acetate Butyrate	6	4	3	2	4200	3700	3500	3000
henolic (Cast) (No Filler)	6	4	4	3	4600	4000	3500	3000
henolic (Laminated) Paper and Canvas Base	6	4	4	3	4500	4300	4000	3500
henolic (Laminated) Glass and Asbestos Base	6	4	4	3	3900	3400	2800	2500
henolic (Molded—Rag Filler)	6	4	4	2	3000	2500	1800	1800
henolic (Molded—Wood Flour Filler)	6	3	3	2	4400	3600	2700	2500
olystyrene (No Filler)	6	4	4	3	4700	4500	4200	4000
rea Formaldehyde (No Filler)	6	4	3	3	4700	4500	4200	4000
elamine Formaldehyde (No Filler)	6	4	4	3	4500	4300	4000	3700
inyl (No Filler)	6	4	3	2	4700	4500	4200	4000
ethyl Methacrylate	6	4	3	2	3600	2800	2500	2300

MILLING

CARBIDE-TIPPED CUTTERS, with the cutting angle ground with a slight rake, are suggested for glass- and asbestos-base laminates and preferred for most laminates. Best results are obtained at higher machining speeds of 600 to 1000 fpm. Indications are that at high cutting speeds a reinforced plastic ruptures ahead of the tool edge, which thus assumes a 2-wedge function. The edge of the tool does not come in contact with the glass, and wear occurs just back of the cutting edge. At lower speeds, the plastic is pushed up to the very edge of the cutter, which must cut the glass by impact. Danger of lifting the lamination at the edge of the cut will be reduced if the cutter mills down on the material.

For fabric-cotton base plastics, best results are obtained by operating at the highest spindle speed the cutter will stand with the maximum feed approximately 20 in. a min.

SHAPING PLASTICS

IN PLANING or shaping, cutting speeds of from 50 to 80 fpm. for glass-, asbestos- and paper-base laminates, and 70 to 90 fpm. are suggested with an approximate feed from 0.010 to 0.015 in. per stroke. Cutting tools should have a cutting angle of about 36°, a clearance angle of 30° and a shearing angle of 45°. The tool must be set so the cut is a shearing action from the surface of the work backward and down.

ROUTING

ACRYLIC and cellulose-acetate sheet materials may be handled on wood shapers, routers and in some cases jointers. Square routing or shaping to templet can best be accomplished with 6 to 10-blade cutters operating at about 7000 fpm. Cutters from ¾ to 5-in. in diam. have been used at from 2000 to 5000 fpm, according to the depth and width of cut, number of blades, type of cut and provision made for cooling and chip removal.

Cutters should be ground with a lip clearance angle of from 10° to 15° and a rake angle of from 0° to 10°. For rabbet routs the cutting teeth should be backed off on the underside to prevent drag and avoid burning. Wherever possible, the corners of routing cutters should be ground to a slight radius so as to produce a fillet at the bottom of the rout, preventing stress concentration.

The acrylic or cellulose acetate must be fed slowly to avoid overheating or cracking. For step routing, where an edge of the plastic bears on a collar as a guide, the collar or edge should be well greased to overcome heating.

Trimming, channelling, stepping, beveling and double beveling may be performed with vertical-spindle routers. Careful attention should be given in selecting spacing rings for beveling work. Pressure of the stock on the cutter should not be too great or the stock will overheat.

SAWING

A STEEL SAW of 60 Rockwell C hardness, hollow ground with 4 to 7 teeth per in., operating at about 10,000 sfpm. is suggested for cotton-fabric-base laminates. For rough cutting or trimming, where smoothness of cut is not important, a set saw may be used. Feed should be steady but not forced. Set saws are not recommended for paper-base materials. Small tubing may be cut by feeding the material straight through the saw. Heavy-walled tubing over ¾-in. in dia. should be rolled through the saw to prevent excessive breakout.

Glass-base and most asbestos-base material can best be cut by using an abrasive wheel. For material under 1-in. thickness a 50-grit wheel, 12 in. in diam. and ⅛ in. thick is adequate. For material 1 in. and over, a steel-centered silicon-carbide wheel of 24 grit about 14 in. by ¼ in. is suggested, at a speed of about 12,000 sfpm. Feed rates suggested are:

Feed, In. per Min.	Stock Thickness, In.
Up to 108	Up to 1
Up to 48	1 to 1½
Up to 24	1½ to 2½
Up to 9	Over 2½

These feeds apply when cutting lengthwise on the sheet. When cutting across the sheet, they should be reduced approximately one-half.

A standard wood-cutting blade, No. 20 gage, with 4 to 7 teeth per in. is recommended for bandsawing laminates. Width of the blade will vary from ⅜ in. to ⅝ in., depending on the radius to be cut.

Hollow-ground saw blades with 40° to 50° clearance and no rake on the teeth are suggested for cellulose acetates. A slight set may be made by hand for stock ½ in. and over, but no set for stock under this. For stock ½ in. thick and over a 10- to 14-in. diam. saw having 4 to 6 teeth per in. and run at a spindle speed of about 3000 rpm. is good practice.

Blades with 6 to 8 teeth per in. and a slight set and running at approximately 8250 fpm. give a smooth cut on acrylic material. As a general rule, the thicker the material, and the larger the diameter, the fewer the required number of teeth will be.

In band-saw operation on this material fine teeth, with no set, produce a smooth cut if the work is fed slowly. Coarse teeth with a slight set permit a more rapid feed but produce a rougher cut. In cutting curves, set is necessary, even though narrow blades are used. For continuous heavy work on material over 1 in. thick a 22- or 23-gage blade is recommended. On lighter work, a 26- or 28-gage blade will give good results. A range of speeds from 1,000 to 1,500 fpm. is suggested. In heavy cuts, including stacks of thin sheets, water is a good lubricant and reduces smoking and smearing the edge of the cut. Oil is used when equipment corrosion is a factor.

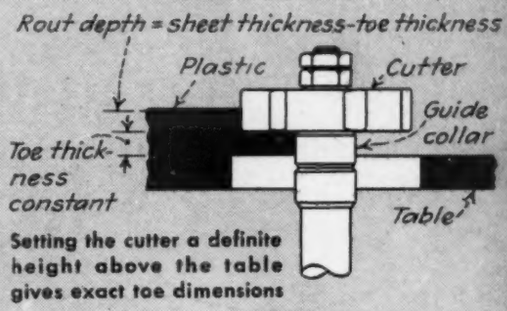
PUNCHING

PUNCHING DIES for laminated materials are practically the same as those for metal, except that little clearance is allowed between punch and die and punch and stripper plate. Laminated

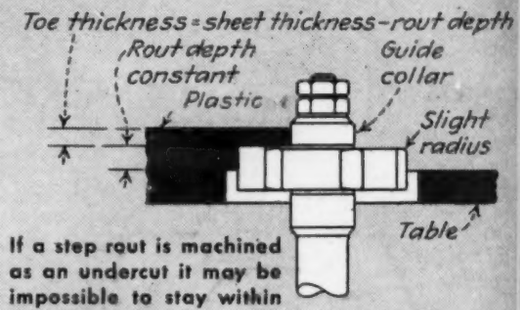
DOUBLE-BEVELING

A thicker ring results in a smaller bevel

STEP ROUTING

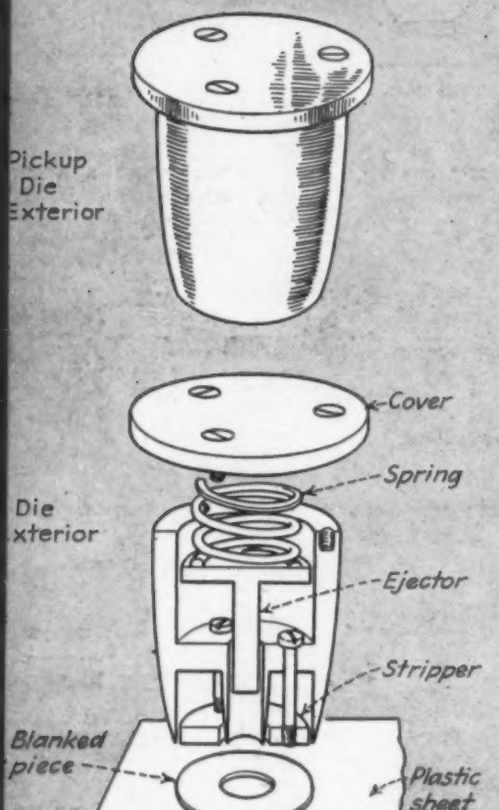


Setting the cutter a definite height above the table gives exact toe dimensions



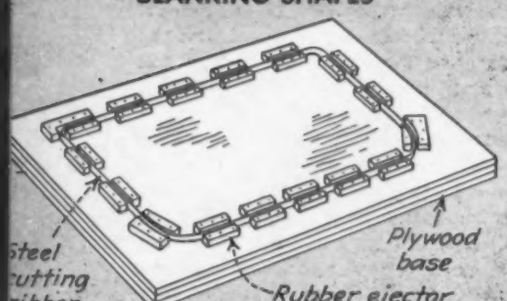
If a step rout is machined as an undercut it may be impossible to stay within desired tolerances in both depth of rout and toe thickness unless this operation follows that above

BLANKING CIRCLES



For blanking circular shapes from thermo-plastic sheet or strip an ejector-type punch is used

BLANKING SHAPES



Steel-rule dies are widely used on cellulose-acetate and acrylic sheet and strip materials

materials yield somewhat when punched so an allowance of about 3% of sheet thickness is made for this.

Shear reduces power required and in some cases makes a cleaner-edged blank, but it is not recommended for hole-punching because one side of the punch, stripping first, will raise the edge of the material. In blanking, shear should be applied to the punch only. In punching holes, no back clearance should be given the punch, as this would leave too much clearance between punch and stripper and pull up the edge of the hole on the back stroke. If edges are inclined to become torn or rough in blanking, a large blank should be punched and passed through a shaving die (a hollow or ring die with a 45° cutting edge). Number 6 Stellite applied by oxyacetylene welding is recommended for the cutting edge, put on a soft-steel body.

The punch should be soft brass, slightly concave on the face and a sheared fit. Stroke of the press should be adjusted so the punch clears the blank out of the die at each stroke. If the blanks are allowed to be built up in the die, shavings may drop in between blanks. A good speed range is from 70 to 300 strokes per min., depending upon the size of machine and work.

Some punching grades can be punched up to 3/32 in. thick. Harder grades may be heated to around 120 F. and as high as 225 F. for heat-resisting grades. Relatively smooth edges can be obtained when materials are punched hot up to 1/16 in., checking is apt to occur above this. Generally speaking, better edges are obtained from fabric-base materials.

Cellulose-acetate sheet can be readily blanked and punched with an accuracy of approximately plus or minus 1/64 in. Sheets over 0.040 in. thick are usually cut singly. Stock above 0.060 in. thick requires heating to produce a clean cut without cracking or chipping. Sheets from 0.060 to 0.125 in. thick can be slightly warmed by being placed under a hot-air blower for about 2 min. to bring them to a surface temperature of about 100 F. before being cut. As stock thickness increases, the temperature must be raised.

BLANKING

FOR SMALL PIECES, steel blanking dies of conventional type may be used. In blanking pieces of large area, a steel rule or clicking die is cheaper. The exposed edge of the steel rule should be extremely sharp. The thin steel ribbon is bent to conform to the pattern to be cut mounted in a plywood backing plate. At intervals along the periphery of the die rubber stops hold the plastic in place prior to cutting and eject it from the die after it is cut. This method of blanking is usually limited to sheets 0.150 in. thick and under. For thicker stock, a knockout die with approximately 5/16-in. thick steel tapered to a sharp blade is used. Open-faced dies may be used to eliminate the extra step of removing each blanked piece from the sheet by hand.

An allowance of about 1/16 in. overall is allowed for contraction of the thermoplastic sheet of large shapes upon cooling.

SHEARING

THIN-SHEET LAMINATES can be cut by hand with sheet-metal shears, or they can be cut with foot-power squaring shears such as are used for thin sheet metal. Sheets ⅛ in. to ⅜ in. can be cut on power shears used for steel plate. A clearance of 0.002 to 0.003 in. should be maintained. The hold-down must hold the material firmly along the entire sheet to prevent work from slipping. For best results, the sheet should be heated as for punching, using somewhat lower temperatures.

When cellulose-acetate sheeting is heated, it becomes plastic and the weight of the knife compresses the material to a slight extent. When the pressure is removed after cutting, the material resumes its former size and one edge is slightly concave and the other convex. It is impossible to secure both a very smooth and a straight edge, particularly on a thick sheet.

When the guillotine knife is used on this material the angle of the knife should be 30° at the cutting edge and 25° farther back. The straight face of the knife has a slight angle which produces a flat land of approximately 0.002 in. which is shaped in a hand operation, similar to removing the feather edge with an oilstone.

GEAR CUTTING

A GROWING VOLUME of laminated stock is being used as gear blanks for industrial application. In cutting these blanks, feed should be the maximum without showing marks on the teeth; a coarse feed tends to reduce wear on the cutter edges.

When hobbing the gear, it is not usually necessary to make roughing cuts. Hobs of ¼-in. pitch diameter can be run at about 200 rpm. with feeds of about 0.060 in. If the gears are cut on a shaper, a speed of 125 strokes a minute, using a fine feed, is good practice.

In gear cutting, the laminated stock should be backed up by wood or cast iron where the cutter breaks through the surface to avoid fraying or rough edges. No lubricant is necessary in most gear-cutting procedures, although water may be used if the piece tends to heat up excessively. Carbide-tipped cutters are suggested, particularly for glass- and asbestos-base material.

FINISHING

SPEEDS, COMPOUNDS AND EQUIPMENT

AFTER a plastics product has been molded, cast or otherwise fabricated a number of operations may be required to:

1. Remove sprue, gates or fins from molding operations.
2. Restore or impart smooth or polished surfaces.
3. Bring dimensions within a critical tolerance that may not have been maintained in preceding steps.

These requirements may involve tumbling, tumble-polishing, sanding, ashing and polishing, filing, buffing. In many cases the bulk of sprue and flash may be removed at the molding machine. The most effective way of removing the runner from the casting is with a positioning fixture in a hand, kick or punch press. To give the best appearance and prevent the runner from breaking into the molding, it is desirable that the gate should be cut from both sides rather than from one side. The blades should have a taper on both sides, and be adjusted in the press so they come within a few thousandths of meeting.

TUMBLING

WHEN THE FIN is at the edge of the molded piece, and averages about 0.015 in. in thickness, it can nearly always be removed by tumbling.

Round or hexagonal open-type tumbling barrels, with heavy wire mesh or perforated metal, are preferred for this operation. In closed barrels, the fin or flash breaks off, and in the case of phenolics, becomes pulverized and adheres to the surface of the molded piece. Molded parts should be allowed to cool for about 3 hr. before tumbling to avoid surface scratches.

The barrel should be loaded within 75% of its capacity, particularly with large parts or ones with inserts, to avoid too much drop. If the parts are particularly light, medium-weight blocks should be added to the drum to speed up the process.

Recommended speeds vary between 40 and 70 rpm. depending on the type of material and the amount of charge. Under average conditions about 10 min. tumbling will remove fins from thermosetting parts.

TUMBLE-POLISHING

WHEN GREATER GLOSS or luster than that delivered by the mold is required, parts may be polished by tumbling. The tumbling method is always used on small parts, such as bottle caps and buttons, which could not be economically polished by any other method. For phenolics and many thermosetting compounds, wooden shoe pegs or sawdust saturated with a preparation of carnauba or paraffin wax which has been dissolved in hot turpentine is a good polishing medium. The sawdust or wooden pegs are then tumbled until a satisfactory coating of the wax preparation has been obtained. The barrel is loaded to about 80% capacity with equal amounts by volume of molded parts and prepared pegs (too small a charge can cause overheating and inferior polish). Approximately 6 hr. will provide a lustrous finish.

In polishing cast phenolic pieces which are quite rough, wet tumbling should be the first operation and the barrel should not be loaded above the center line. In loading all barrels, 4 oz. of FFF pumice should be mixed with each standard pailful (12 qts.) of parts and enough water to barely cover the articles. At 30 rpm. a good matte finish will be secured in about an hour's running time.

Dry tumbling in hexagonal barrels, which operate at about 30 rpm. for 5 to 12 hr., will polish cast phenolics which have been well machined. Barrels are loaded with 3 parts pegs, 2 parts plastic units, 1 cup of FFF pumice and 1½ cups of flushing oil or paraffin oil.

At the end of running time, the articles should be thoroughly cleaned of pumice, using kerosene-soaked sawdust (2 qt. of kerosene to 12 qt. of coarse hardwood sawdust) in a small barrel or keg operating end-over-end for about 5 min. Proportions of half sawdust and half articles are generally used. Articles should then be removed from the sawdust, washed and dried. The sawdust may be used repeatedly.

SANDING

A VERTICAL-BELT SANDER is used for finishing operations on many types of laminated tubing, with these recommendations:

Rough Cutting...Grit Size No. 50 to 70
Medium Cutting.Grit Size No. 160-180
Fine Finish.....Grit Size No. 200-240

Sanding may also be used on laminates for facing and shaping surfaces, roughing preparatory to gluing, and for removing burrs and sharp edges from the work.

Wet sanding is preferred to dry sanding unless the surface of the particular stock being sanded can be marred by water being left behind on it. Water sprayed, or otherwise applied to the belt, reduces frictional heat, helps keep the abrasive from clogging, prevents dust and increases cutting speed. In wet sanding, a No. 100 grit silicon-carbide belt gives a sufficiently smooth finish, if the part is to be dipped or otherwise coated. If a No. 240 grit belt is used only buffing is necessary for a final finish.

Only fine-grit sandpapers are used in finishing acrylic plastics. Grit size 320A is the coarsest used, while grits up to 600A are preferred. Silicon-carbide abrasives on A-weight backing are suggested for this material, and wet sanding reduces frictional heat to a safe point.

Drum sanders are suitable for use on curved edges of sheet plastics, while disk sanders are suggested for removing material from straight edges and outside curves. Air-driven grinders and small electric hand grinders are best fitted for sanding small areas of large pieces which are awkward to manipulate around a fixed machine. Jigs promote accuracy in sanding edges to specific dimensions.

ASHING

THIS IS A BUFFING OPERATION used to remove the major irregularities on the surface of an article after sanding, giving a dull surface which usually requires further finishing.

Wheels are built from large and small muslin disks. As the small disks, or spacers, increase the distance between the large ones, the greater the proportion of spacers the softer the wheel will be. Wheels generally used are:

HARD WHEELS—Consisting of 2 spacers placed between every 3 large disks and used for removing deeper marks and to ash flat surfaces.

SOFT WHEELS—Alternating 2 spacers and 2 disks or even 3 spacers and 2 disks, are used for removing small scratches. This type is used most frequently on thermoplastic parts.

New large muslin disks are 12 in. in diam., while spacers are 6 in. Unless the loose threads of muslin are removed before the wheel is used, the cutting action will be reduced. To remove these threads, or to dress the wheel, any sharp tool can be pressed on the wheel's surface while it is running.

Equal amounts of ½ and 1½ grades of pumice mixed with water is introduced between the wheel and the work. If the mixture is too dry, the stock will overheat. Occasionally it is necessary to polish a large surface; then a self-cooling type of wheel may be used advantageously. Wheels should always be drawn up tight at the spindle, and are usually 4 to 6 in. wide. For ashing, a wheel speed of between 2000 and 3000 sfpm. is suitable for most plastics, the higher range of speed being preferred for cellulose acetates and acrylics. Wheel nd work should be in constant motion with relation to one another to dissipate heat efficiently.

Similar techniques, equipment and speeds are suitable for any following steps such as polishing. The speed range is slightly higher, and a compound with less cutting action is used. Jewelers' rouge or tripoli is used as the reducing compound.

FILING

REMOVAL of heavy flash or fin formations on molded products is often accomplished by filing. Coarse files are often used on thermoplastics because they do not load up as quickly as fine-cut files, although the latter must be used when a smoother finish is required. Flat, half-round and shear-tooth files are most commonly used. Considerable care should be exercised in designing holding fixtures for plastics parts which are to be filed, as undue stressing while the plastic is comparatively warm is dangerous.

With the shear-tooth type, teeth cut at a 45° angle provide a rapid cutting action. Light pressures, in long sweeping strokes to the right, prevent clogging and maintain a sufficiently fast stock removal. Clogging is not such a problem with thermosetting materials, because of their higher hardness and heat-resistance.

In machine filing, recommended peripheral speed is from 450 to 600 fpm. However, hand filing is usually a preferred method because the file surface may be used at will, and the twist or slide essential to good filing may be applied.

BUFFING

LESS CUTTING ACTION and higher speeds than for preceding operations are suggested for buffing. Double-end polishing equipment is used for buffing molded parts, one wheel cutting and the other buffing. Wheels for use on phenolic materials are usually made of soft muslin, widely separated and with loose stitches.

Abrasives such as tripoli, crocus and rouge are mixed with waxes as a bond. These preparations are cast into bars to simplify application of compound to the wheel surface.

The "cutting" operation is mainly used when the mold parting line is actually on an important surface and must be removed by a stronger action. Cutting also removes scratches and eliminates inferior surfaces.

Buffing is used to restore the lustrous finish, after the molded part has been constantly handled during the various finishing operations. Speed for both cutting and buffing of thermosetting materials is about 6000 fpm. Too high a speed can cause difficulties, especially on irregular surfaces where the high centrifugal force will not allow the wheel to form itself to the contour of the part unless heavy pressure is applied. Experience is generally the deciding factor in stepping up buffing speeds on specific shapes and types of plastic.

WE ACKNOWLEDGE...

The plastics industry covers a broad field of materials and numerous methods of processing these materials. Fortunately the industry is exceptionally well equipped with data covering its complex operations. We acknowledge the provision of this material, as well as the personal counsel of qualified authorities. For valuable reference, particularly on transfer molding and sketch suggestions covering certain molds, we are indebted to J. H. DuBois, Executive Engineer, Shaw Insulator Company, and W. I. Pribble, General Electric Company, and their comprehensive work on mold design, "Plastics Mold Engineering", (American Technical Society, 1946). Jet molding, referred to in this summary, is a patented process of Plastic Processes Inc. Transfer molding, also discussed briefly, is licensed by patent from Shaw Insulator Company. We thank the following companies for contributions and reference:

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The Dow Chemical Co.
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Durite Plastics
Elmes Engineering Works
The Formica Insulation Co.
General Electric Co.
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The Hydraulic Press Mfg. Co.
Lea Manufacturing Co.
Lester Engineering Co.
McAleer Manufacturing Co.
Marathon Corp.
Morse Twist Drill & Machine Co.
Monsanto Chemical Co.
National Electrical Mfg. Association
Nixon Nitration Works
Owens-Corning Fiberglas Corp.
Plaskon Division, Libby-Owens-Ford Glass Co.
Plastic Die & Tool Corp.
Plax Corp.
Reed-Prentice Corp.
Rohm & Haas Co.
Sav-Way Industries
Society of the Plastics Industry, Inc.
Spaulding Fibre Co. Inc.
Synthane Corp.
Tennessee Eastman Corp.

ROUND TABLE

Should A Foreman Be Boss or Gang Leader?

"I HEAR the boys in the shop think you're goin' fancy," kidded Ed, "paintin' up them machines and all. They say it ain't comin' to work anymore—it's more like comin' to a pink-tea fight. They're thinkin' of gettin' their overalls pressed."

"A couple of them already have," corrected Al. "Swenson and O'Malley got their wives to sew in creases and have taken to going around with cover glasses stuck in one eye like monocles."

"What did you do about it—tell 'em off? After all, it's your experiment, not theirs."

"But they're a part of it, Ed, so they have a right to opinions. No, all I did was to get a couple of 3-ft. lengths of reinforcing bar and bend hooks at one end, so the boys with the monocles also have canes—we used to call them 'sticks' in the Easter parade."

"So you just make the gag worse, eh, al? Why don't you put your foot down and show 'em who's boss? If you clown around when they clown, you're not goin' to have much authority."

"I don't want much, Ed—just enough to keep the shop running as it ought to. After all, if I have to be a tough guy to get the work done, I won't get much cooperation or much help from the men. Bossing 'em around kills their own initiative."

"You sound like a progressive schoolmarm, Al. How come so many ideas were worked out in all the hundreds of years gone by? This business of not bossin' people was never heard of until a few years ago. If bossin' was going to kill initiative, it sure would have when we were apprentices."

"It sure *did*, Ed. How many times did you have an idea that would have helped the boss, and just kept quiet about it because you were sore at him? And how many times have you seen the guy at the next bench doing something wrong and didn't say a word because you felt it was his business? If a shop gang cooperates, things like that don't happen."

"Says you. Cooperation, as you call it, won't stop credit hogs or soft-soapers, or any of the other kinds that take a firm hand to keep 'em in line. The old rule about sparing the rod and spoiling the child works in the shop too."

"Just because a man believes in being reasonable instead of being hard-boiled and tough is no sign he's going soft. Some people have to be bossed, Ed, but you can do it in more ways than with a club. It's a lot more effective to get the people around a troublemaker working on him than to try it yourself."

"Doctor of Psychology, Al, eh? If you keep that kind of thinkin' up, you'll need your head examined."

IS BOSSING NESESSARY? *Can you "catch more flies with honey than with vinegar" in running a shop? Your opinions or suggestions will be appreciated and those published will be paid for. Discussions of earlier topics are published in later pages of this issue.*

Impact Forging

IMPROVES STEEL'S PHYSICAL PROPERTIES

Mechanical working of hot steel by impact-forging results in the production of shapes and changes the properties of the metal

BY R. E. W. HARRISON
VICE PRESIDENT, CHAMBERSBURG ENGINEERING COMPANY

INHERENT weaknesses, that exist in steel as cast, are the consequence of solidification. Crystallization of large masses of metal, especially ingots, is necessarily slow, and the resulting formation of relatively coarse crystals of varied composition and form leads to variable physical properties. In addition, a looseness of structure, sometimes actual cavities, is left by reason of the varying contraction during the cooling of the mass which exists at all stages from the beginning of solidification down to the final temperature.

Hot mechanical working of steel has the effect of modifying the crystalline structure by breaking up coarse crystals and massive segregated constituents, and also of knitting together and in many cases, actually joining up by welding loosely cohering or separated parts of the mass. Mechanical working develops grain flow which follows the direction of working. Therefore, impacted forgings possess a distinctive direction of flow of their component crystals which gives them added physical properties.

The importance of "grain" is recognized practically in forgings by the adoption of forging methods that will cause the grain or fiber to follow in the finished part, in that direction most conducive to strength. A gear blank or other cylindrical shape, where great strength or maximum wear or both are required on the periphery, demands consideration of this feature. When thin cylindrical shapes are forged by the hammer-upset process, the grain takes up a direction which is approximately radial from the center, and the shape possesses a grain which has the appearance of a spoked wheel. This grain flow runs along each individual tooth (as in a gear), and as a result, the gear teeth possess better physical properties than where the grain does not take up this outward direction.

Thus forging develops in steel: 1. Increased density

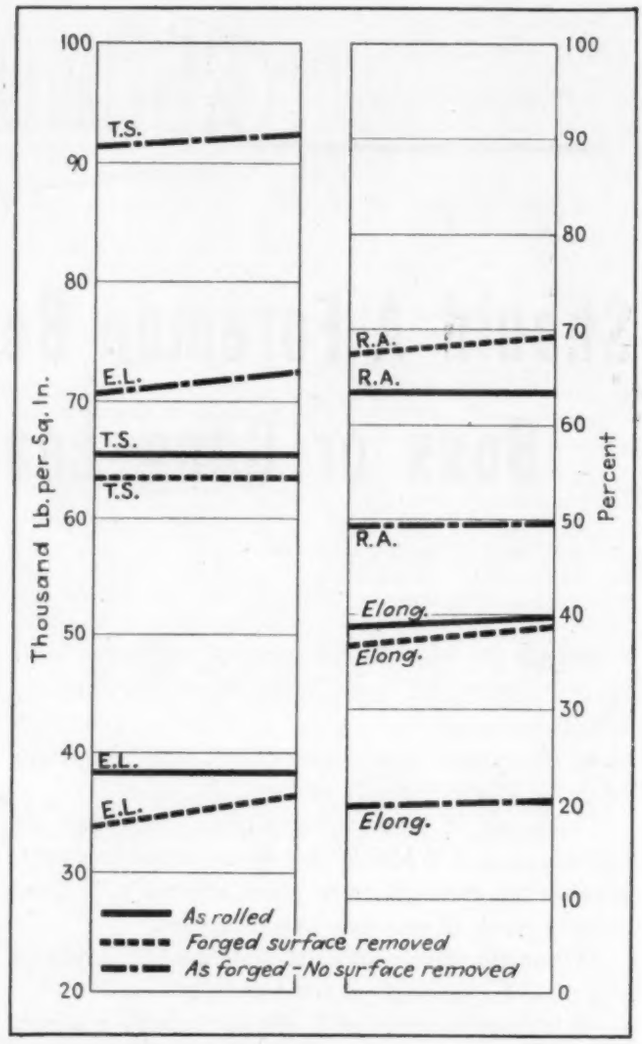


Fig. 1—Effect of hammer-forging on the physical properties of SAE 1020 steel—test bars not heat-treated

TABLE 1
PHYSICAL PROPERTIES OF SAE 1020 STEEL

As-rolled—test bars not heat-treated		
Test No.	1	2
Elastic limit, psi	38,500	38,200
Tensile strength, psi	65,900	65,900
Reduction in area, %	63.7	63.7
Elongation, % in 2 in.	39.0	40.0
Forged—surface removed from forging		
Test No.	1	2
Elastic limit, psi	34,100	36,500
Tensile strength, psi	63,800	63,800
Reduction in area, %	67.6	69.2
Elongation, % in 2 in.	37.0	39.0
Forged—no surface removed from forging		
Test No.	1	2
Elastic limit, psi	70,800	72,800
Tensile strength, ps	91,300	92,500
Reduction in area, i%	49.5	49.8
Elongation, % in 2 in.	20.0	20.2

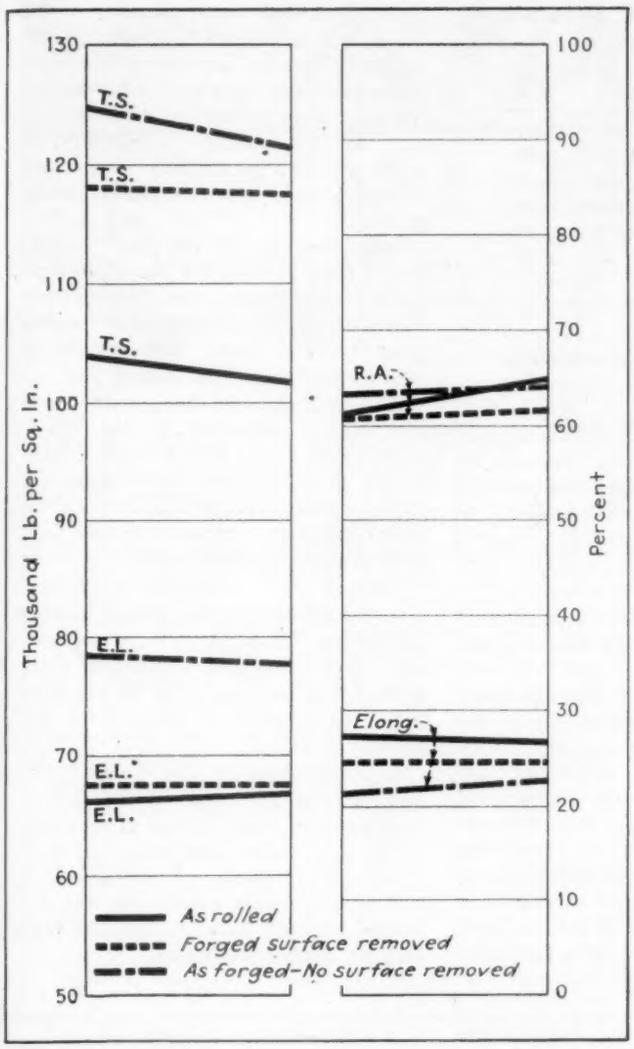


Fig. 2—Effect of hammer-forging upon the physical properties of SAE 3140 steel—test bars normalized but not hardened

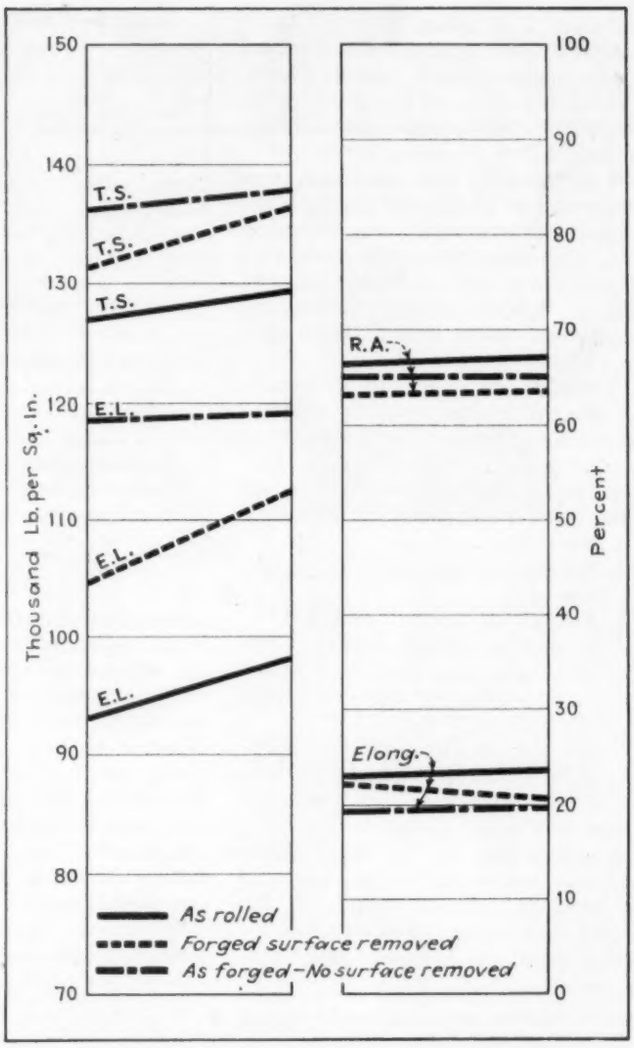


Fig. 3—Effect of hammer-forging upon the physical properties of SAE 3140 steel—test bars normalized and hardened

TABLE 2
PHYSICAL PROPERTIES OF SAE 3140 STEEL

As-rolled—normalized Test No.	1	2
Elastic limit, psi	66,200	66,400
Tensile strength, psi	114,100	112,100
Reduction in area, %	61.4	65.1
Elongation, % in 2 in.	27.5	26.5
Brinell hardness	241	241
Forged—surface removed from forging (normalized) Test No.	1	2
Elastic limit, psi	67,900	67,300
Tensile strength, psi	118,200	117,600
Reduction in area, %	60.9	62.0
Elongation, % in 2 in.	25.0	25.0
Brinell hardness	228	228
As Forged—no surface removed (normalized) Test No.	1	2
Elastic limit, psi	78,400	77,800
Tensile strength, psi	125,000	121,300
Reduction in area, %	63.9	64.4
Elongation, % in 2 in.	21.8	23.1
Brinell hardness	228	228

TABLE 3
PHYSICAL PROPERTIES OF SAE 3140 STEEL

As-rolled—normalized, hardened, and drawn Test No.	1	2
Elastic limit, psi	93,700	98,200
Tensile strength, psi	127,100	129,300
Reduction in area, %	66.5	67.2
Elongation, % in 2 in.	23.6	24.0
Brinell hardness	302	302
Forged—(surface removed) normalized, hardened and drawn Test No.	1	2
Elastic limit, psi	104,900	112,200
Tensile strength, psi	131,400	136,900
Reduction in area, %	63.5	63.6
Elongation, % in 2 in.	22.5	21.0
Brinell hardness	302	302
Forged—(no surface removed) normalized, hardened, and drawn Test No.	1	2
Elastic limit, psi	118,900	119,100
Tensile strength, psi	136,700	138,000
Reduction in area, %	65.2	65.1
Elongation, % in 2 in.	19.5	20.0
Brinell hardness	286	286

of metal. 2. A grain flow or "fiber."

Specific-gravity tests made on rolled and impact-forged carbon steel. Chemical analysis of the heat: Carbon, 0.87; Manganese, 0.25; Phosphorus, 0.006; Sulphur, 0.006.

A rolled-steel test specimen was taken from a 600-lb. ingot. The forged test specimen was obtained from the same ingot. The reduction of area from ingot to forged bar was 95.5%. Specific-gravity determinations were: rolled steel 7.831, Forged steel 7.849.

A study was made to determine the effect of forging upon the physical properties of steel. The two types of steel used are listed in Table 4. Test bars were prepared and produced in three different physical conditions:

1. As rolled.
2. Forged, surface of forging removed.
3. Forged, no surface removed.

One steel was tested with no heat-treatment and one steel was tested in two conditions of heat-treatment, as indicated in Table 5.

Table 1 gives the physical properties of SAE 1020 in the three physical conditions with no heat-treatment. These results are plotted in Fig. 1.

A comparison of the elastic limit and tensile strength shows a decrease in forgings after removal of the forged surface compared with the as-rolled condition. The as-forged, without surface removed, shows a considerable increase in both elastic limit and tensile strength.

Table 4—CHEMICAL ANALYSES

	SAE 1020	SAE 3140
Carbon	0.21	0.38
Manganese	0.55	0.69
Phosphorus	0.022	0.020
Sulphur	0.034	0.026
Nickel	——	1.08
Chromium	——	0.63

TABLE 5—HEAT TREATMENTS

SAE 3140
Normalized 1650 F.
Hardened...1525 F. Quenched in oil.
Tempered...1100 F. Cooled in air.

The principle of the forging hammer is that of an instantaneous application of force applied to a relatively small area governed by the size of the dies and the sections of the metal being forged. The first application of force must overcome the initial resistance to deformation of the metal, after which plastic flow will occur as long as the force is continued in motion and in magnitude. Coincident with the application of the force, the density of the metal is increased. The suddenness of the blow tends to localize the effect and confine the maximum refinement of the structure to the exterior. Therefore, it is known that the surface has greater density, hence higher physical properties.

Table 2 gives the physical properties of SAE 3140 in the three physical conditions. These test bars were normalized after rolling and forging prior to machining. The results of these tests are plotted in Fig. 2.

A comparison of the elastic limit and tensile strength in the chromium-nickel steel shows a marked increase in each group of forgings. A considerable increase is shown on the as-forged bars compared to the bars with forging surface removed.

Table 3 gives the physical properties of SAE 3140 in the three physical conditions. These bars were normalized, hardened and tempered after rolling and forging, prior to machining. The results of these tests are plotted in Fig. 3.

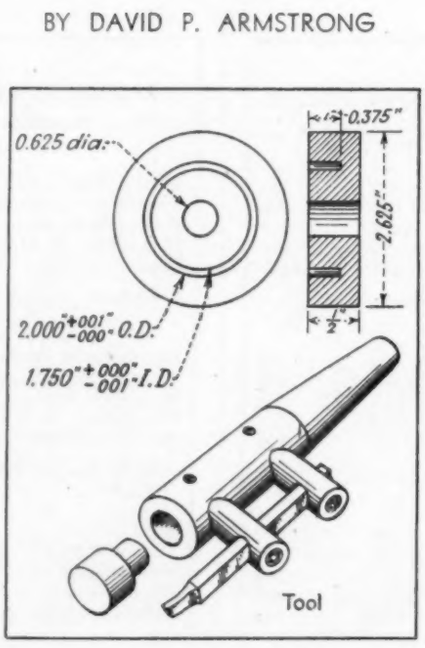
A comparison of the elastic limit and tensile strength in the chromium-nickel heat-treated steel again shows a marked increase in each group of forgings. A considerable increase is again shown on the as-forged bars compared to the bars with forging surface removed.

Machining a Deep Narrow Circular Groove

BY DAVID P. ARMSTRONG

THE PIECE of brass illustrated was 0.500 in. thick and had a ⅛-in. circular groove 0.375 in. deep. Bar stock was cut into slugs 0.531 in. wide and all these slugs were faced on one side. They were held in a three-jaw chuck, faced, bored to 0.625 in., and grooved with the special tool made up as indicated. The tool was made with a pilot turned to 0.625 in. for a length of 0.500 in. and to an O. D. of 0.500 in. for ½ in.; machined at one setting to insure absolute concentricity. The hole for the 0.500-in. end of the pilot was bored for a hand press fit. The tolerances on the I. D. and O. D. of the circular groove were plus .001, minus .000. A cylindrical gage was made from a piece of tubing to check the accuracy of the groove as machined and to facilitate setting the tool to size on a practice piece.

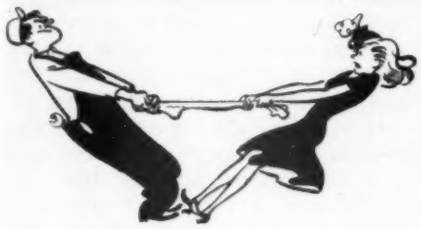
The side walls of the groove were



clean and smooth, but there were slight chatter marks at the bottom of the groove. These marks were not objectionable because a tube was to be inserted into the groove. The chatter marks were quite pronounced when the pilot was removed. It was thought that the chatter might be eliminated if two tool bits were used, one on each side of this special holding device, but this would have necessitated a delicate problem of grinding the bits to size to cut the proper groove. With only one tool bit in this special holder the utility of the tool for similar work is maintained.

Perhaps some reader might know how chatter might be eliminated entirely in such a machining operation. There was no need for it on this job, but there probably are jobs like this that must be done without any chatter whatsoever.

TALKING SHOP



Battle for Nylons

MILADY'S NYLONS may have to compete with metalworking uses for priority before we're through. Tests are underway on nylon conveyor and power belt carcasses.

No Better Than The Mold

RECENT CONVERSATIONS with plastic molders, including the biggest, indicate that most have no yen for making their own molds and tools. Too much investment in equipment, too much required know-how. Says one: "The tool and die shop knows tools, and above all it knows metals. It is more alert to the new techniques of making and finishing tools. It can usually afford the type of equipment necessary to produce a mold at minimum cost. We work with our custom tool and die maker as if he were a part of our engineering staff." Unless the molder has other products than plastics which require a full time toolmaking staff, he's apparently content to specialize in plastics and leave the metalworking to other specialists.

Kirksite Lingo

WONDER what an old-fashioned die sinker thinks of the mechanic who talks of a die that begins on a "loft," receives a "mock-up," then has a "splash," and finally ends in a "flask" before it is ready for hand-finishing. We're becoming so specialized we don't understand each other any more.

Mikes for the Blind

MANY PLANTS employed blind inspectors during the war, equipping them with fixed gages of snap, ring or plug types or with comparators employing audible signalling devices. Two British firms, however, developed adjustable precision measuring instruments for the blind. The first is a micrometer with drums carrying scales and Braille numbers in relief. A narrow fixed drum carries the zero line, a second the fixed scale of the barrel and the third the thimble scale. The other tool is a height or slide gage with a positive scale formed by notches 1 in. apart on the beam. A pawl on the head engages these notches. Intervals of 0.1 in. are provided by ten arms pivoted to the saddle which can be swung into line with the micrometer spindle as desired. A disk on the micrometer screw has 25 peripheral notches, each representing 0.001 in., so it makes four complete revolutions to equal the thickness of one pivoted arm. A click pawl engaging the notches makes a sound as each is passed and locks the disk temporarily at the zero point, assuring correct counting. Such tools broaden the scope of work possible for a group of steady, reliable, accurate workmen.

Milk vs. Oil

MILK WAS THE FIRST cutting fluid used on aluminum, and gave the trouble you'd expect from souring and separating. More recently, to avoid complications with milk in testing homogenizing equipment, soluble cutting oils have been used. It seems that milk and cutting oil are quite similar in the necessary characteristics—but don't tell a cow. Or don't tell us, because our first drillpress had a coolant pump that constantly lost its prime. The only method we knew to recover it was to suck on the outlet pipe. Ever taste a mouthful of soluble oil?

No-flame Cutting

Some of these days, somebody will be flame-cutting without flame. In one case we heard about, aluminum 0.065 in. thick was cut at a reasonable rate by a 70-lb. air jet passed through an ozone generator and entraining heated water. The jet was only 0.016 in. in dia., and cut a fine 0.020-in. kerf. Apparently, ozone released by the jet corroded the surface of the metal, creating an oxide.

The water jet scaled off the oxide and did some pitting on its own account—erosion and corrosion working together at cutting speed. Don't try this one anywhere but in the open; enough ozone is released so it cuts lung lining. Or so we're told.

Saboteur = Ozone

That cutting method reminds us of the experience of one 37-mm. gunmaker early in the war. As he set up his production line, he tried out each operation with several-score sample barrels. When the line was complete, he offered the test barrels as his first production. After borescope examination, Army inspectors rejected them—pin-point corrosion in the tube and breech. They looked like someone had sprayed spots with an acid atomizer. The saboteur was found to be condensation between operations, with ozone eating into the nickel steel. Maybe you think that manufacturer didn't begin using rust inhibitors!

Sign of the Times

JOHN MECK INDUSTRIES, Plymouth, Ind., now boasts the JMI Flying Club. Employees pay $1.25 a year to belong, own a new Piper *Cub* and take lessons at the local airport at odd hours. The company owns a Nordyne *Norseman* for flying trips of personnel or the radio equipment it manufactures.

Whose Tools?

WHO REALLY OWNS our tools of production? Henry J. Taylor delved into the question and came up with this answer: Approximately one-fifth of all the tools in America are owned and used by individual farmers. Something like one-tenth are owned by millions of individual business and professional men and women: doctors, dentists, architects, hairdressers, butchers, bakers and candlestick makers. They include everything from a hand organ to a jeweler's eyeglass. About three-fifths of all the tools are owned by companies and corporations which, in turn, are owned by millions of stockholders.

Limits of Triode Pliotron

TOTAL VOLTAGE available is divided into two parts; one, voltage across the load; and two, voltage across the tube.

When we want maximum power in the load, we increase the electron flow through the tube, thereby providing more current and power for the load. Under this condition, the voltage across the load is greater, leaving a low voltage across the tube. The effect on the tube is that with low tube voltage the anode is less positive and least able to attract electrons, right at the time when we want maximum current flow.

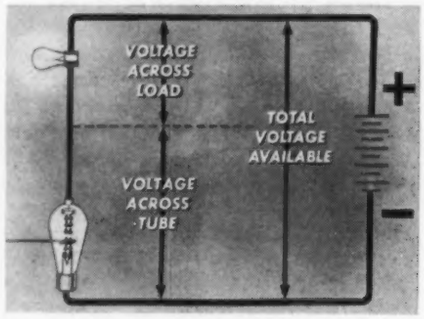
Just the opposite occurs when we want less power in the load. We decrease the electron flow in the tube, providing less current and power for the load. Under this condition, the voltage across the load is smaller, leaving a high voltage across the tube. The effect on the tube is that with the high tube voltage, the anode is most positive and has the greatest attraction for electrons, at the time when we want reduced current flow.

To see how we overcome these limitations of the triode, let us focus our attention on the two jobs that the anode must perform in the triode; one, it attracts electrons; and two, it collects and supplies electrons for the load circuit.

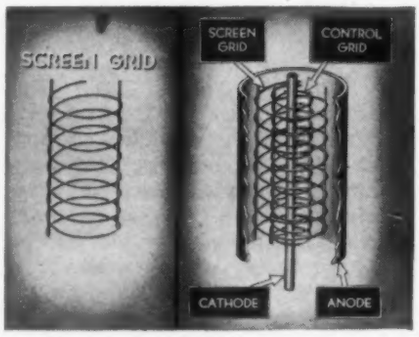
In many types of pliotrons we divide the functions of the anode. The anode collects the electrons for the load, but another element called the "screen grid" accelerates the electrons.

The screen grid usually is a helix of wire similar to the control grid. In most tubes it surrounds the control grid and is between it and the anode. We will picture the screen grid as a flat wire surface similar to our control grid and having a separate terminal to an outside source of voltage.

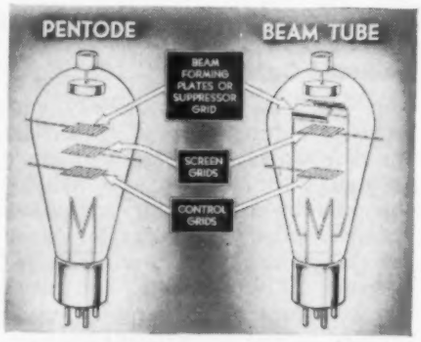
The screen grid has a fixed positive voltage so that a constant positive field is created outside the control grid field. Since the screen grid is more positive than the cathode, it, of course, attracts some electrons to itself, perhaps one-fourth of the total current; but most of the electrons are accelerated past the screen grid to the anode and to the load. The total effect of this constant positive voltage is a more even attraction and acceleration of the electrons. This practically eliminates the undesirable effects of the changing anode voltage.



The circuit diagram indicates that total available voltage equals voltage across the load plus voltage across the tube



The screen grid is a helical wire coil between the control grid and the anode



The triode pliotron is transformed into a pentode or a beam tube by the addition of other elements

The screen grid tube itself has some limitations. Some of the slower electrons may return to the screen grid, increasing the screen-grid current. This is particularly true when the anode is less positive than the screen. To prevent the return to these electrons we place a third grid at cathode voltage, "the suppressor grid," between the screen grid and the anode. Thus we form the five-element tube, or pentode. While we show this grid as a flat surface, actually, the suppressor grid is a helix of wire surrounding the others grids. It is usually connected directly to the cathode.

In certain of the newer tubes the function of the suppressor grid is handled by two metal plates, called beam-forming plates. These beam-forming plates are so shaped and spaced that they focus the flow of electrons into definite paths or "beams." These beam-power tubes are used where the power handled is sufficiently large that the extra efficiency is desirable.

The simple triode pliotron is generally used where maximum power output at high voltages is needed. We find these triodes in the frequency-changing circuits of electronic kilowatts of power. Large tubes are water-cooled to remove the heat from the power losses in them. Because of their simple construction triodes are also used in small electronic timers and in other simple equipments.

By the addition of these other elements such as screen grids, and suppressor grids or beam-forming plates, the simple triode pliotron is developed into pentodes and beam tubes. However, these other elements are of secondary importance to the control grid, nearest the cathode, which is the main control element in all pliotrons.

We find the pentode, which has largely replaced the earlier screen grid tubes, used in the speech amplifiers, in radios, and in general for public address systems which call for high amplification. Pentodes are used to amplify the feeble control signals received from phototubes. We find them in weft-straightening control equipments, which are used for squaring up the weave of cloth in textile mills. In edge-alignment control, changes in light reflected from the edge of the sheet of paper are picked up by the photoelectric eye, and are amplified by beam-power tubes to control the position of the sheet.

Based on a sound slidefilm in the General Electric industrial electronics course.

Practical Ideas

HAVE YOU A PRACTICAL IDEA?... If so, send it in. Your idea will help other men, in other shops, who have a problem similar to yours. We pay for acceptable contributions prepared exclusively for this publication

Production-Developed Fixtures With General-Purpose Applications

T. J. DONOVAN, The Blanchard Machine Company

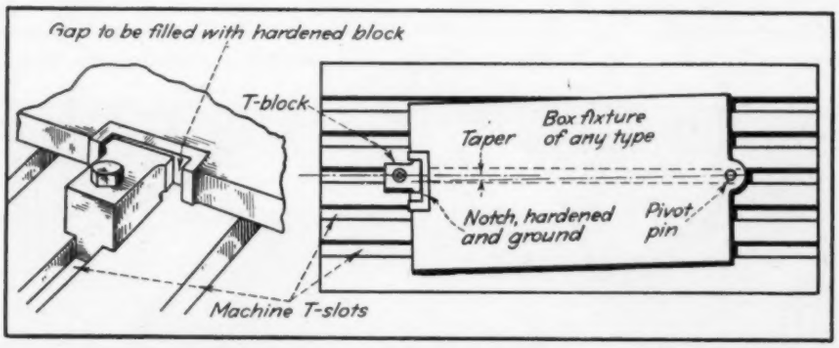
Rotary Faceplate Holds Gearbox

With the large wormwheel as the only purchased item, we built this pedestal to speed up the work on gearboxes for surface grinders. These gearboxes, although basically rectangular, have such uneven surfaces due to the many bosses of different heights, that holding them accurately was something of a problem. As shown here, they are clamped to the faceplate with an adapter which fits a large bearing hole in one end. The pedestal is bolted to the bed of a radial drill and, using a pneumatic motor, the work can be rotated quickly to present any of the four surfaces to the drill.

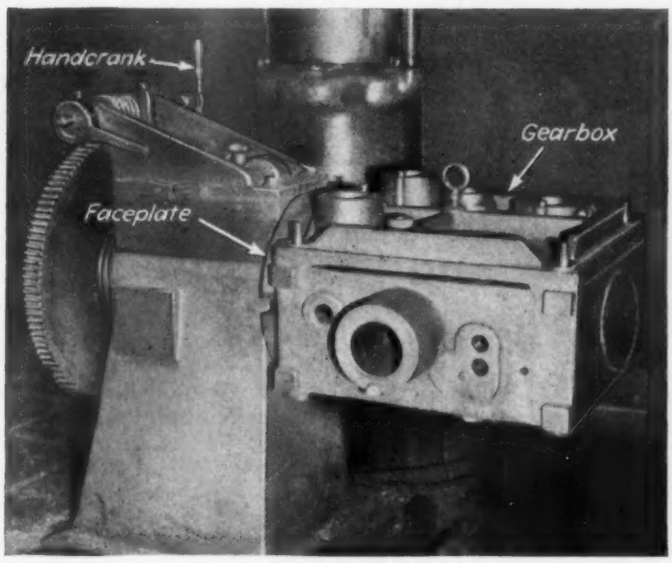
This particular job deals only with right angles, but our work is of broad scope and the quantity of production of each item small enough that we decided to make this a universal fixture, suitable for many jobs. It has a gear ratio of about 100 to 1 and there is a large handwheel on the worm for fine adjustment so any angle can be set quickly. There are two of them in the shop and various adapters are available to set up any of our regular jobs.

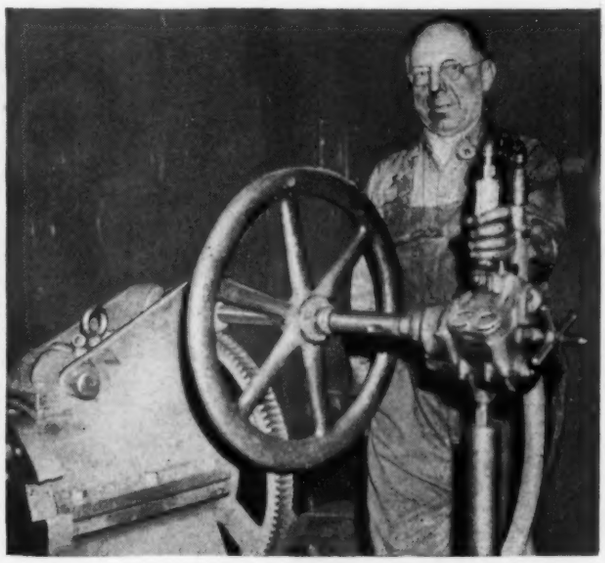
Improved Accuracy for Tapers

Milling, planing and grinding operations of many kinds involving a long gradual taper have been improved using a box fixture arranged as follows: In the T-slot of the machine table there are fitted two blocks. One



Slim, accurate tapers are milled or planed using a wedge block



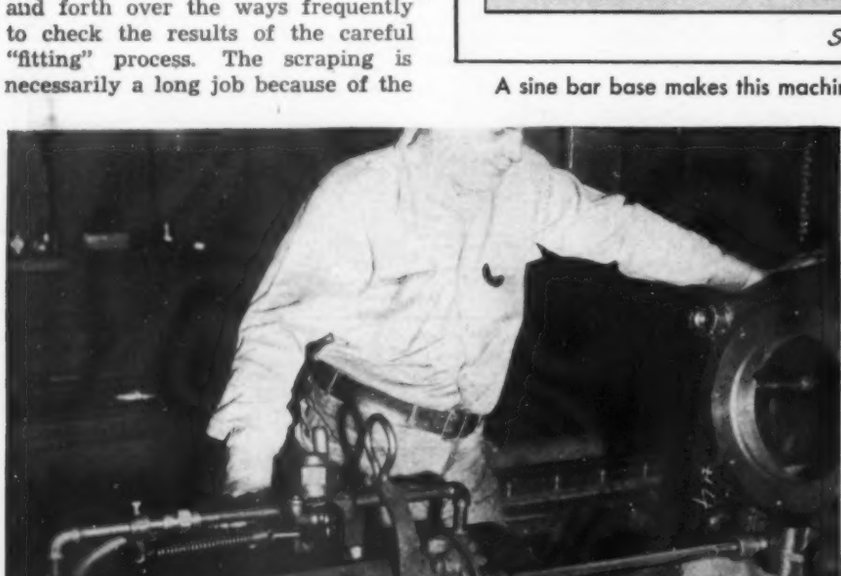


This gearbox is here in position for drilling the holes in the top and bottom faces; next, it will be turned 90° for drilling the other two. At right, the large handwheel and air motor for rapid positioning

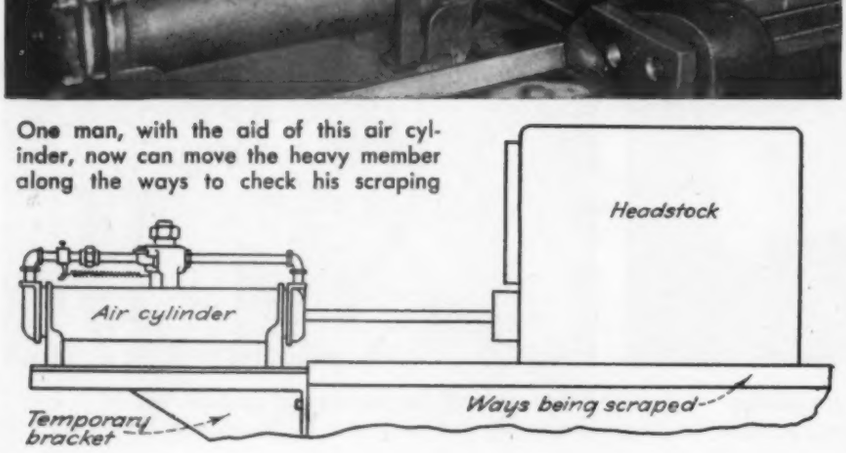
has a ground hole to receive the pivot pin, and is flush with the surface of the table. The other projects above and has hardened and ground sides. The fixture has a ground hole in one end to receive the pivot pin and a ground notch in the other end. With the raised block bearing against one side of the notch, the fixture is parallel with the ways of the machine, but when it is moved over to the other side, an angle is established. Tapers in either direction are then possible, according to the side from which the cut is taken. In the production job for which this fixture was designed, a hardened block filled the gap between the two non-guiding surfaces of the notch.

Air Cylinder For Scraping Ways

Scraping in the ways for large headstocks and similar parts means that the heavy unit must be moved back and forth over the ways frequently to check the results of the careful "fitting" process. The scraping is necessarily a long job because of the high degree of accuracy required, but we thought it unnecessary to have one or more helpers hanging around just to move the big unit over the prussian blue each time. Now, a long stroke air-cylinder is bolted to the end of the machine being scraped, and it is a simple matter to move the headstock back and forth with a two-way air valve.



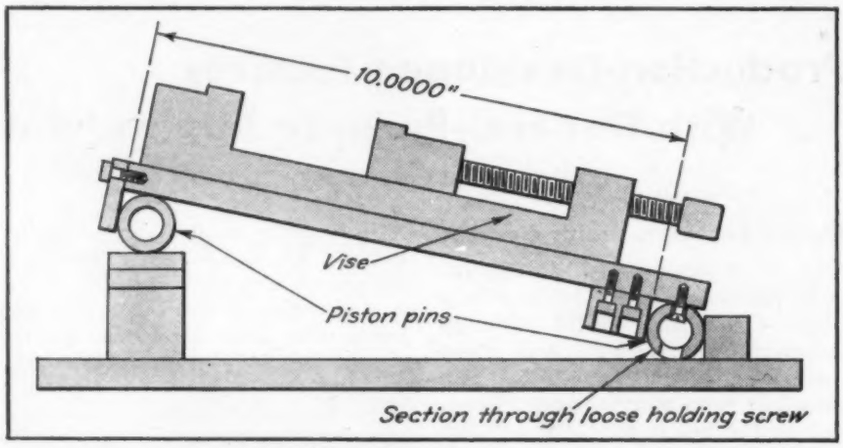
One man, with the aid of this air cylinder, now can move the heavy member along the ways to check his scraping



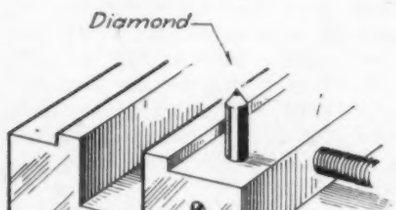
Sine Bar Vise Dresses Surface Grinding Wheels

WALTER DIMITRUK

After a long search for a practical and economical way to dress surface grinding wheels at various angles, I have arrived at this method. It consists of an accurate machine vise



A sine bar base makes this machine vise into an accurate angular fixture



For dressing grinding wheels the diamond has been inserted in the moving jaw of the sine-bar vise

mounted on a strong sine bar angle plate and carrying a diamond setscrewed in the moving jaw. The degree of accuracy is limited only by the parallelism of the moving jaw to the sine bar.

Automobile piston pins were used for the sine bar, and these support the entire width of the vise, making the unit strong enough for most grinding jobs, and eliminating the necessity of changing to an ordinary angle plate after setting up the job on a surface plate. Besides the pins, the sine bar has its own base, the angle plate and two cross members, all made of ground flat stock. The 10-in. dimension is established carefully and then the pins are attached in place, making the plate a single unit. The

method of assembly is, of course, optional: the pins can be left "semi-floating" as shown, or can be solidly fastened to the angle plate in two directions, or they don't have to be fastened at all, for that matter.

The usefulness of this tool is not limited to dressing wheels. With other modifications to suit the job, the moving jaw can be used as a cross-slide for a wide range of work.

Indexing Head For Continuous Precision Link Boring

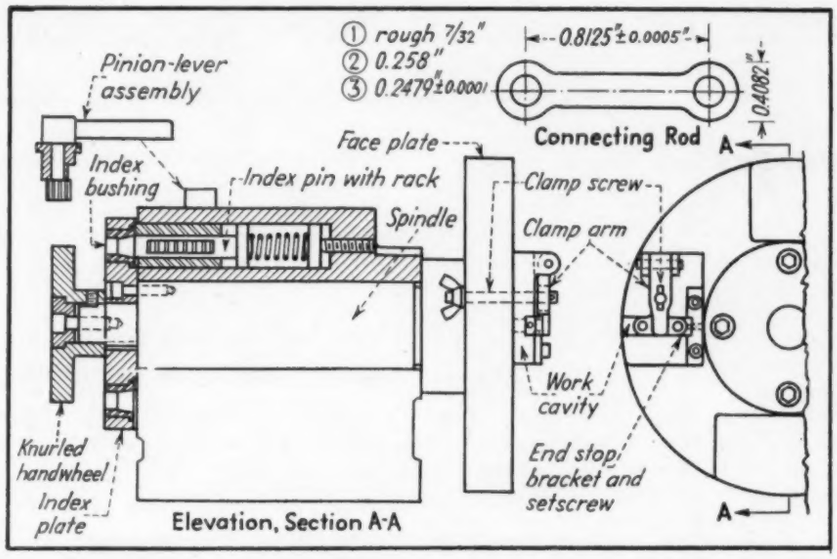
WILTON WOLFF
The Cornelius Company

Links, or articulated connecting rods, were required in large quantities for the 3-cyl. air compressor in the Boeing *Superfortress*.

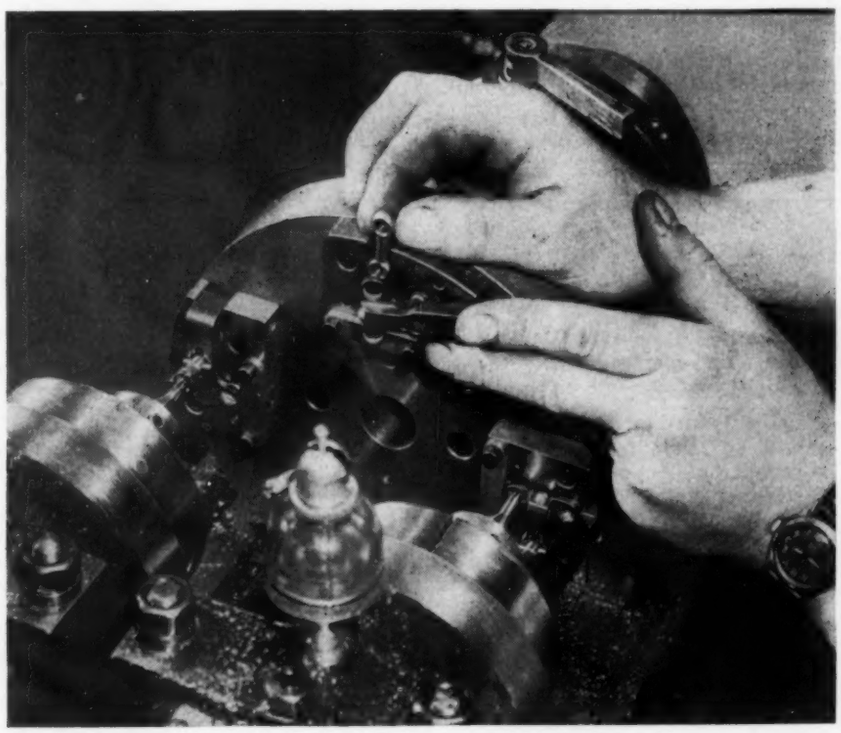
A continuous operating cycle, requiring only loading and indexing, produced 100 parts per hour. The work was done with two Stokerunit 2-spindle Simplex boring machines, one for roughing and the other for finishing the holes.

The indexing fixture has four stations mounted on a faceplate, each with a work-positioning and holding clamp. The spindle is offset with respect to the centerline between the twin boring heads, and the layout of the faceplate is such that the center distance of the connecting rod holes is automatically fixed. Simultaneously, the "inside" hole in one link and the "outside" hole in the link 180° away are bored. The cycle for one piece is: load in top station (while preceding ones are being bored); index 90° and bore the "outer" hole; index 90° for one dead position; index 90° and bore the inner hole; index 90° and remove finished piece and reload. The indexing is controlled by a plate mounted on the rear end of the spindle and a spring-loaded locking pin in the housing. The locking pin has a rack cut in one side, and its hardened bushing is slotted to permit the pinion on the retracting lever to mesh in the rack. The pin is a taper-fit in hardened bushings in the indexing plate, insuring maximum concentricity and no slop.

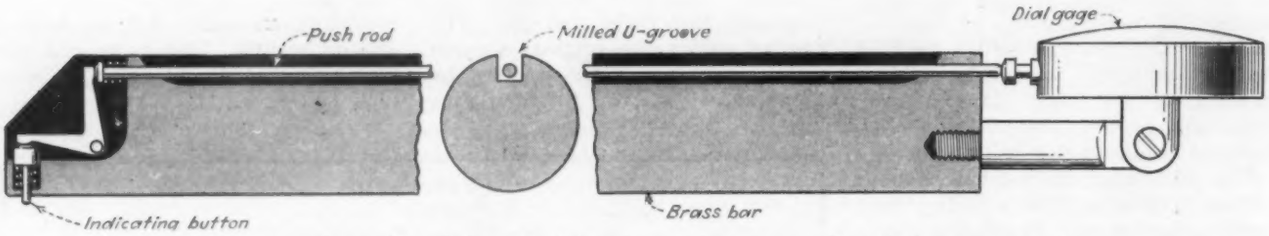
As shown, the links are held radially on the faceplate. The work cavity controls the lateral positioning of the piece, which has already been finished all over on the outside, while an adjustable stop across the bottom of the slot controls the depth to which the links can go. The drawing shows the original version of the clamp arm, later modified by extending it past the fulcrum, thus providing an easier way of loading and unloading. The wing nut has been eliminated and spring tension alone now does the job.



The centerline offset and the radial positions of the clamping brackets in this fixture were calculated to obtain the proper center distance for the connecting rod. Indexing is manual: a pinion lever retracts the racked lock-pin while the knurled handwheel is turned to the next station



Twin boring heads finish the holes in two connecting rods while the operator removes a finished piece and reloads the top station. The left spindle bores the outer hole in the rod; two indexings later the right spindle will bore the inner hole in the same piece. Note the indexing pin lever by the operator's right hand



For large work, in deep holes, this 24-in. bar makes an excellent dial gage extension

Rigid Deep Hole Wiggler Gages Long Cylinder Bores

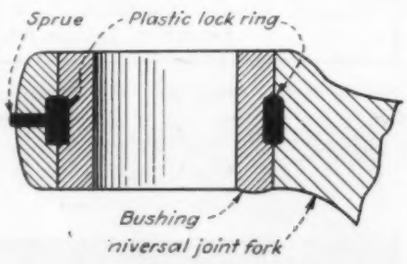
H. M. JAMES

Many people have built extensions of their own design for the commercial wigglers, but here is one I made about two years ago which has several features a little out of the ordinary.

The heavy supporting bar is 1¼ in. in diameter and 24 in. long and has a groove milled in one side to accommodate the gaging rod or push rod. Inasmuch as there is considerable movement of the bellcrank itself, it was thought worthwhile to make the gaging button independent of the crank in order to obtain straight line action and eliminate the error due to the curved path of the crank. The contact points of the crank are at right angles at all times, and any angular error at one end is automatically offset by an opposite error at the other end of the bellcrank. Two springs (similar in action to the valve and push rod springs in a valve-in-head engine) prevent backlash between the dial gage and the button, although they must not be strong enough to affect the spring within the gage itself.

Plastic Locking Rings Simplify Assembly And Repair Operations

The German Wehrmacht developed a handy system for locking various parts together which not only streamlined their production but also made maintenance and repair much easier. The illustration below shows a typical example. This is one of the forks of the drive shaft universal joint. The solid black portion is plastic which is injected while warm through a sprue in one side and allowed to harden at normal temperatures. There is plenty of strength . . . easily as much as conventional snap rings . . . but dismantling consists merely in shearing the plastic in an arbor press, or even tapping with a hammer and drift. Repair men in the field are equipped with a simple gun, very much like a pressure grease gun to remake the joint.



Squirting plastic, which soon hardens in the air, into the groove between the bushing and its fork, replaces snap rings in this universal joint

Machining is also simplified: the bushing, or outer ball race, in some cases, is an accurate fit in the fork, of course, but the annular groove in both pieces can be very rough, as long as the two correspond approximately. When axial positioning of the bearing is important, other means must be included to locate the parts.

NOW . . . $25 for the best Practical Idea in each issue

Jury of readers, different each time, to select top suggestion. Anyone with an idea can enter

Until further notice, an extra payment of **$25** will be made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

Payment—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

Judges—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, will hereafter select the best Practical Idea. If at any time their votes result in a tie, duplicate payments will be made. Judges' decisions are final in each case.

Requirements—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

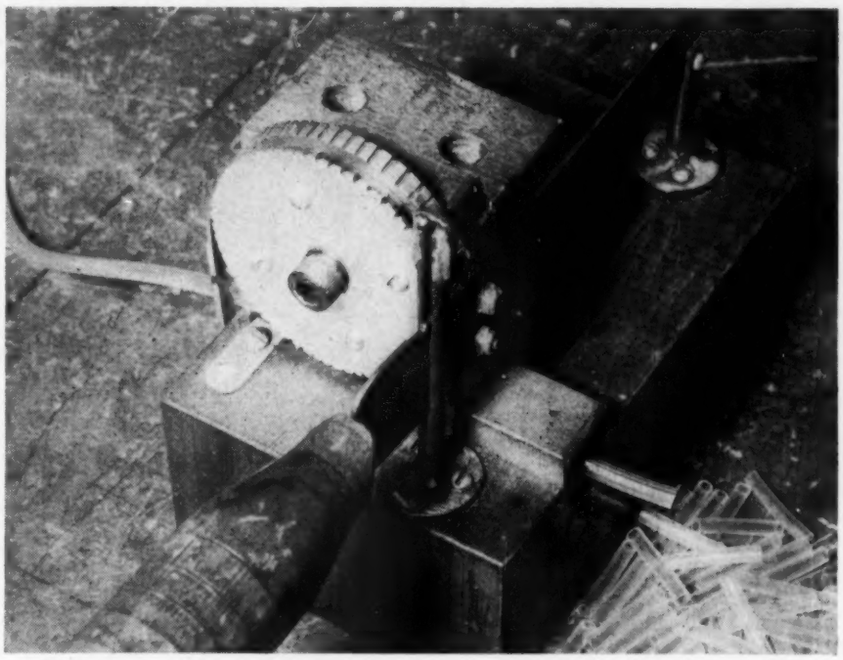
Who May Enter—Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments.

Spaghetti Cutter Makes Plastic Tubing Cutting Easy

V. FRED RAYSER

Short lengths of "spaghetti" tubing for radio and other insulation jobs on electronic and testing equipment are now made much more quickly with the aid of this device.

A knife is ground from an old file and mounted on a wooden block as shown. A pedestal at one end acts as a pivot for the blade while a split-pedestal at the other end becomes the guide. To the knife blade is bolted a piece of flat spring, bent to make a ratchet. This ratchet slips along the wheel on the cutting stroke but when the knife is raised, the ratchet engages the serrated wheel and turns it counterlockwise about 1/12 of a turn thus feeding the tube automatically for the next cut. The tool is admittedly a bit rough, but it is easy to adjust. The feeding groove for the tube (which is quite soft and flexible) allows just enough space for the tube to squeeze by the wheel when the wheel is turned. The socket capscrew provides enough friction to prevent the wheel from slipping in the wrong direction when the ratchet brushes by on the way down, but not enough to make the feeding motion difficult. Adjustment for length of each piece can be made by regulating the upward stroke of the knife but this is limited anyway by the period of engagement of the ratchet, which travels in a straight line, with the wheel which naturally travels in a circle.



Raising the knife causes a flat spring to engage in the notched wheel and feed more tubing. Friction prevents motion on the downstroke

Clock Spring Prevents Floating Lathe Dogs

ALBERT LARSON
Foreman, Gage Dept., Vard, Inc.

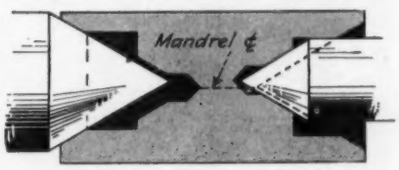
When grinding left-hand threads on small gages, the direction of rotation of the grinding wheel tends to pull the dog away from its driving surface, resulting in lead error. One way to overcome this difficulty is to fit a spring to the back side of the dog. A clamp, holding a piece of clock spring, was made to fit over the headstock center. In setting up the work, the ring is rotated until the spring bears firmly against the dog, and then locked. This system absolutely prevents any chatter or backlash between the dog and the driving center regardless of torque.

Lathe Mandrel For Concentric And Eccentric Turning

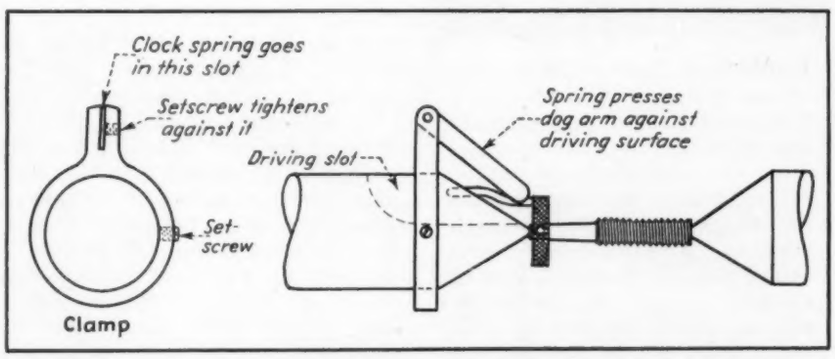
H. MOORE

We had a job consisting of several lots of disk eccentrics, each with a different throw. It was decided to turn them on special mandrels between centers, which had, in addition to the regular center holes, eccentric locations for each size so the work could be finished without removing from the mandrel. When the eccentric distance was greater than the center hole diameter, it was easy enough to bore the additional holes. But in one case the throw was only 1/32 in., so we devised this solution.

The mandrel has a deep chamfered counterbore with a center hole at the bottom in each end. With the mandrel in one position, the headstock



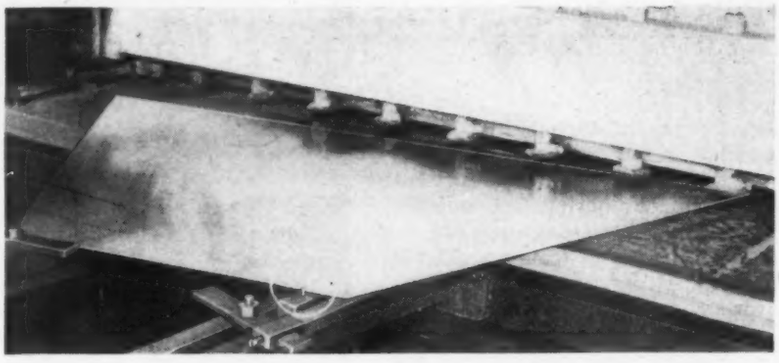
In this position, mandrel is eccentric Turned end for end, the headstock center will ride the concentric chamfer and the tailstock center will fit the centered hole. Note the difference in size between the two centers and how the inner holes just clear the large center

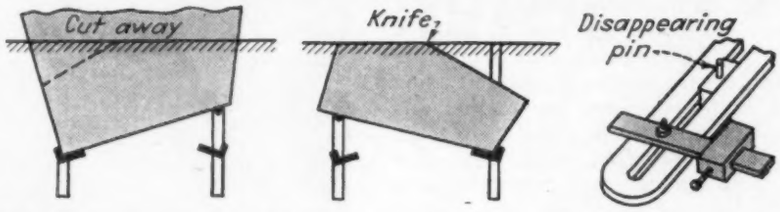


Light work on centers, which may tend to move away from the dog, is steadied with a clock spring setscrewed to the center

center supports one end of the concentric chamfer, and the tailstock center, which clears the counterbored hole, supports the other end in the concentric center hole. Turning the mandrel end for end presents the eccentric chamfer to the headstock center and the eccentric center hole to the tailstock center.

To make the mandrel, first determine the counterbore diameter. It will simplify the work if this is made the sum of the tailstock center diameter and the diameter of the eccentric circle (twice the throw). Then, the tailstock center will always rest on one side of the hole. This counterbore is made in each end, once on center and once at the correct throw, deep enough to allow for the small center holes which must clear the headstock center. Now drill these center holes, centered and eccentric but with the ends reversed.





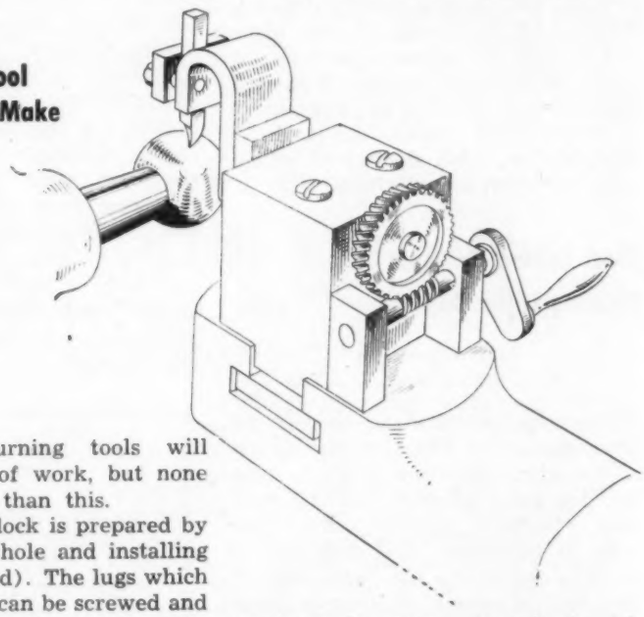
Multiple Locating Pins — The addition of two spring-loaded pins to the set-up bars of this shear permitted two cuts to be made on each sheet. Since much time formerly was spent in picking up and restacking, this expedient has proved valuable. Photo (above) shows second cut, corresponding to second sketch.

The piece to be cut is laid on the setup bars over one of the pins, which is depressed flush by the weight of the piece, and positioned with one T-bar and the other pin. After this cut is made, the piece is shifted, depressing the opposite pin and pushed into the other T-bar for the second cut. *Developed by J. E. Lewis, North American Aviation.*

Utility Hand Truck—The features of this dolly are its light weight and small size in proportion to the work it can handle. Too often, the available trucks are too big and heavy, and there are too few to go around, and so much material is carried by hand rather than go to the bother of securing a truck. As can be visualized, these will take up little space when not in use, and are available when needed. *M. C. Blazer, Beech Aircraft Corporation.*

Radius-Turning Tool That's Quick To Make

EDWIN KRAUS



Many radius-turning tools will handle all kinds of work, but none could be simpler than this.

A rectangular block is prepared by drilling the shaft hole and installing bushings (if desired). The lugs which support the worm can be screwed and doweled in place on one end, and a tongue screwed on the bottom. A vertical hole a little off center to clear the shaft is finally drilled for the long T-bolt which secures the tool on the compound rest. A crank or knurled knob completes the tool itself; various adjustable toolholders are easy to prepare to suit the job. This one was made from a U-strap for turning outside radii. If it is felt that the side pressure created by having the tool on top of the work would be unduly hard on the compound feedscrew, this can be blocked and the screw backed a trifle.

Fabrication of Porcelain-Enameled Parts—I

COURTESY OF THE PORCELAIN ENAMEL INSTITUTE, INC.

MORE TROUBLE arises in porcelain enameling from poor design and fabrication of parts than from the enameling process itself. Unlike ordinary sheet-metal fabrication, the part must possess strength to resist repeated heating to high temperatures for fusing the enamel. Therefore, more attention must be paid to selecting the proper metal gage, size and shape of the piece and forming method.

Metal Thickness

Warping, sagging, hairlining and chipping result from improper metal thickness. Drawn parts, although sections may be flat in appearance, are more prone to warp than pieces produced by other methods. A heavier gage may prove helpful. Some guidance in selecting the proper metal thickness is provided by the table.

METAL THICKNESS vs. PART AREA

Gage	Width, In.	Area, Sq. Ft.
24	6	½
24	12	*3
24	18	*5
22	6	1
22	12	3½
22	18	*6
22	24	*8
20	6	1½
20	12	5
20	18	*8
20	24	*10 to 15

**Should be embossed, flanged or reinforced. All parts larger than indicated should be made of 18-gage or heavier material.*

Flange Design

Most parts are flanged. The minimum depth of flange is 3/8 in., the minimum radius of curvature 3/16 in., when parts are to be enameled in white or light colors, 9/64 in. for dark colors. If the minimum radius is not observed, the ground and cover coats will burn off and there will be difficulty in securing adequate coverage.

Flanges visible at final assembly, especially if 1 in. or more in width, must be kept straight and at an exact angle. This is difficult unless the flange is supported during enameling. Safest method is to make end flanges equal in depth the long, or exposed, flange, or at least one-third the length of the exposed flange. If this is impossible a light-gage reinforcing strip may be spotwelded to both flanges, but not to a surface to be finished. Sometimes temporary bracing can be used, as shown at *D*, below.

Cutouts, notches and holes larger than 5/16 in. should be avoided in narrow flanges. Such points concentrate stresses and transmit them to the flat surface that the flange is supposed to support. Where cutouts can not be avoided, the corners should have at least a ¼-in. radius, and the die should not be set too close so as to burr the inside of the flange for strengthening purposes.

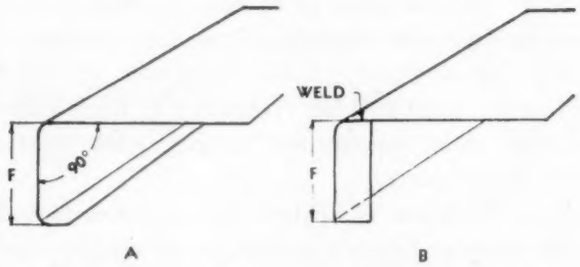
It is good practice to weld open corners where flanges meet, to improve rigidity, avoid warpage, reduce danger of chipping in handling and assembly.

Parts can be embossed to avoid tendency to warp. In all cases, the radius of corners should not be less than 3/16 in. Make embossed sections symmetrical with the outline of the piece to minimize unequal stresses.

Bolt holes should be punched 1/16 in. larger than nominal bolt size. Thus, after allowing an enamel thickness of 0.015 in. over the edge of the hole, the clearance is approximately 1/32 in.

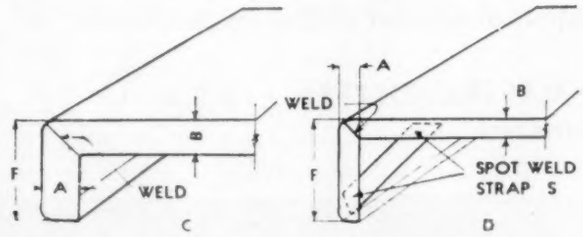
Welding

Remove drawing compound before welding, as the carbon deposit produced may cause enamel defects. A neutral flame should be used, and the operation carried out as fast as possible to avoid distortion. Corner



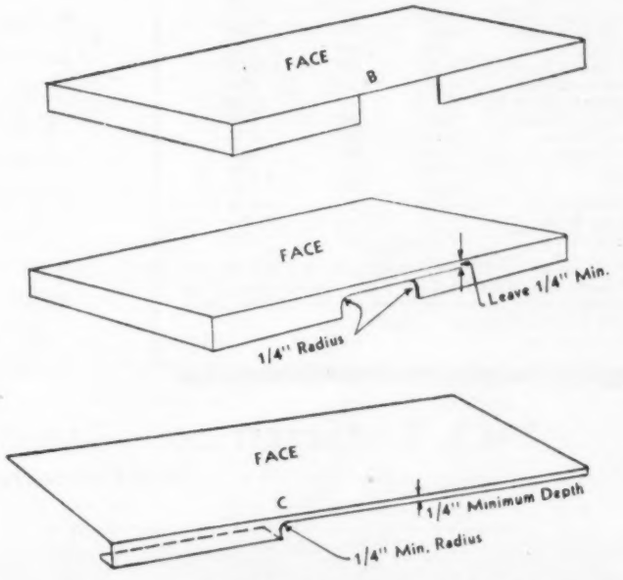
A — Design Weak. Flange F will change angle in firing

B — Support provided by end flange inadequate



C — Good Design. A = B = 1/3 F. Flange F is properly supported and will hold angle

D — Alternative Method. If A & B are less than 1/3 F additional support provided by strap S



Flange is weakened by decrease in depth. Hair lining is apt to occur at C. Chipping may, or may not occur.

FOLLOW THIS GUIDE TO HACKSAW ECONOMY

The chart at the left gives you the right pitch and, for machine cutting, the right speed for cutting almost any material.

FOR HAND SAWING

Material		Teeth per Inch
Aluminum	Solids	14
Angles	Heavy	18
Angles	Light	24
Babbitt		14
Brass	Solids up to 1"	18
Brass Pipe		24
Brass Tubing		24
Bronze	Solids up to 1"	18
BX Cable	Heavy	24
BX Cable	Light	32
Cast Iron	Up to 1"	18
Channels	Heavy	18
Channels	Light	24
Cable	Heavy	18
Copper	Solids up to 1"	14
Drill Rod	Over ¼"	18
Drill Rod	No. 30 to ¼"	24
Drill Rod	No. 30 and smaller	32
General Purpose Cutting		18
Iron Pipe		24
Metal Conduit		24
Sheet Metal	Over 18 gage	24
Sheet Metal	Under 18 gage	32
Steels	¼" to 1"	18
Steels	¼" and under	24
Tubing	Over 18 gage	24
Tubing	Under 18 gage	32

FOR POWER SAWING

Material to be Cut	Teeth per In.	Strokes per Min.	Weight or Pressure, Lbs.
Aluminum Alloy	4-6	150	60
Aluminum, Pure	4-6	150	60
Brass Castings, Soft	6-10	150	60
Brass Castings, Hard	6-10	135	60
Bronze Castings	6-10	135	125
Cast Iron	6-10	135	125
Copper, Drawn	6-10	135	125
Carbon Tool Steel	6-10	90	125
Cold Rolled Steel	4-6	135	150
Drill Rod	10	90	125
High Speed Steel	6-10	90	125
Machinery Steel	4-6	135	150
Manganese Bronze	6-10	90	60
Malleable Iron	6-10	90	125
Nickel Silver	6-10	60	150
Nickel Steel	6-10	90	150
Pipe, Iron	10-14	135	125
Slate	6-10	90	125
Structural Steel	6-10	135	125
Tubing, Brass	14	135	60
Tubing, Steel	14	135	60

When using "S-M" Molybdenum or High Speed Steel Saws, the same pitch of teeth may be used, but the speed can be increased. Coolant Should Be Used For All Materials Except Cast Iron.

STARRETT HACKSAWS

The list below describes briefly the wide range of Starrett hand and power hacksaws from which you can select the right blade for any job.

FOR HAND SAWING

- *Starrett Standard* Flexible Back, All Hard or "Semi-Flex" blades cover all ordinary service requirements.
- *Starrett "S-M" Molybdenum* blades are specially tempered for fast cutting of hard metals at low cost per cut.
- *Starrett 18-4-1 Tungsten* High Speed Steel blades handle all the hard-to-cut metals.
- *Starrett "Safe-Flex"* high speed steel blades with flexible back and hard edge are virtually unbreakable however tough the job.

FOR POWER SAWING

- *Starrett "S-M" Molybdenum* saws have a remarkable record of production performance at low cost per cut.
- *Starrett High Speed Steel* 18-4-1 Tungsten all hard blades are ideal for light and heavy sawing of high alloy metals, stainless steel, phosphor bronze, tool steels, chrome steel, monel, etc.

Every Starrett Hacksaw is milled, heat treated, tested and inspected to meet Starrett standards of quality and value.

Be sure you use the right Hacksaw for the job. Ask your mill supply distributor for *Starrett* Hacksaws.

THE L. S. STARRETT CO. · ATHOL · MASSACHUSETTS · U.S.A.

World's Greatest Toolmakers

STARRETT

PRECISION TOOLS • DIAL INDICATORS • GROUND FLAT STOCK
HACKSAWS • METAL CUTTING BANDSAWS • STEEL TAPES

Fabrication of Porcelain-Enameled Parts—II

welds, although most frequently used, are more likely to cause chipping and hairlining than welds near to but not at the corner.

Drawing

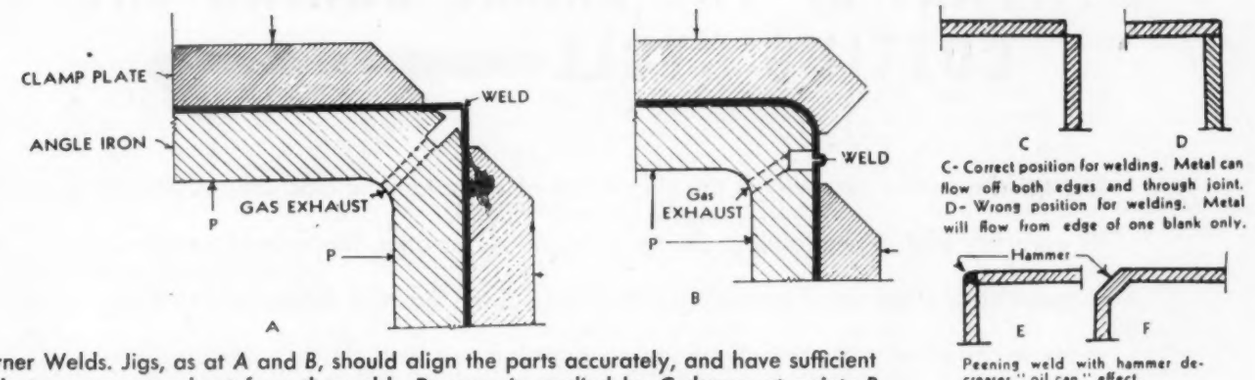
Dies must be designed to control plastic flow of metal so that its internal arrangement is not disturbed by subsequent drawing operations. Die clearances should be such that the metal assumes the desired shape with uniform cross-section or thickness. In compound shapes, work out the tooling sequence so that parts are formed with least amount of internal stress and greatest uniformity of wall thickness. Welds should be placed at the tangent points of radii. But do not trim at such points as this leaves a feather edge that interferes with enameling. If possible, trim by shearing in the semi-formed state and perpendicular to the plane of the fabricated part, then reform to final shape. This will provide a finished edge of full thickness.

Removal of lubricating compound must be done thoroughly and at minimum cost. A soap and water mixture is satisfactory for light drawing operations. For more difficult shapes, compounds should be readily saponifiable, contain little or no pigments and have a non-oxidizing vegetable-oil base. After the part has been fabricated, it should be pickled in an alkaline bath to remove all oil, dirt or grease. If stored prior to cleaning, parts should first be pre-cleaned with solvent, then pickled.

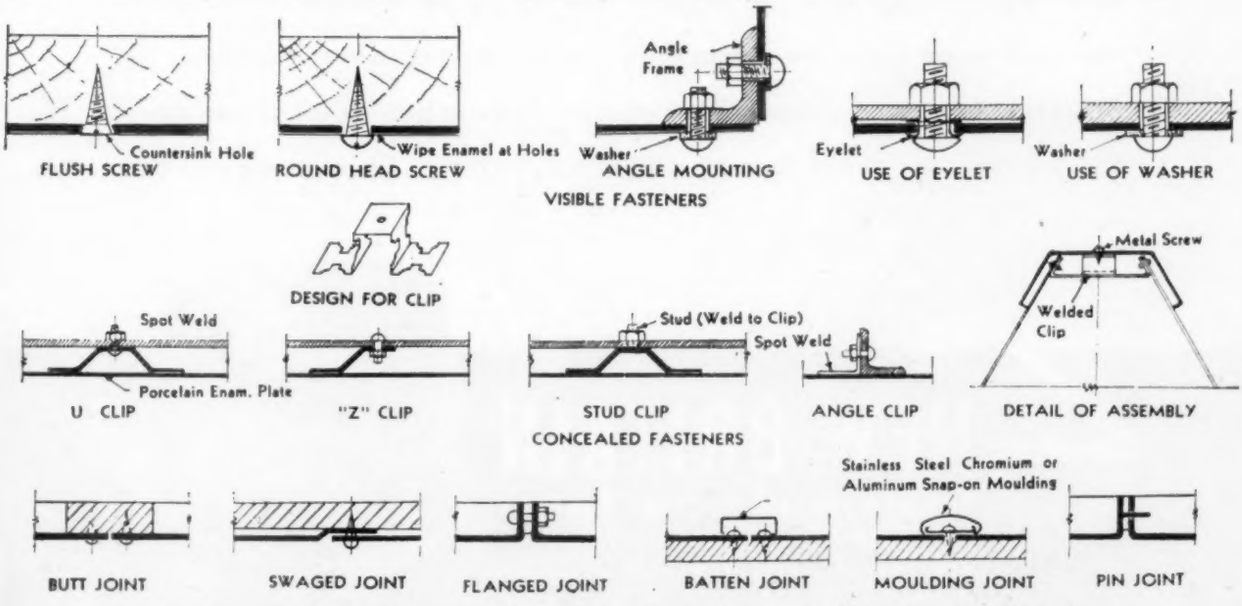
Chief consideration in forming parts is to avoid internal strains in the metal. Return flanges are not advisable. Tools should not fold flanges first and crowd extra metal to the center. A rim-bound part will grow and warp during firing. Hold the center with a pressure pad and form edges and flanges last. A flanging-press blank holder should have sufficient grip to prevent slippage.

Shearing the Blanks

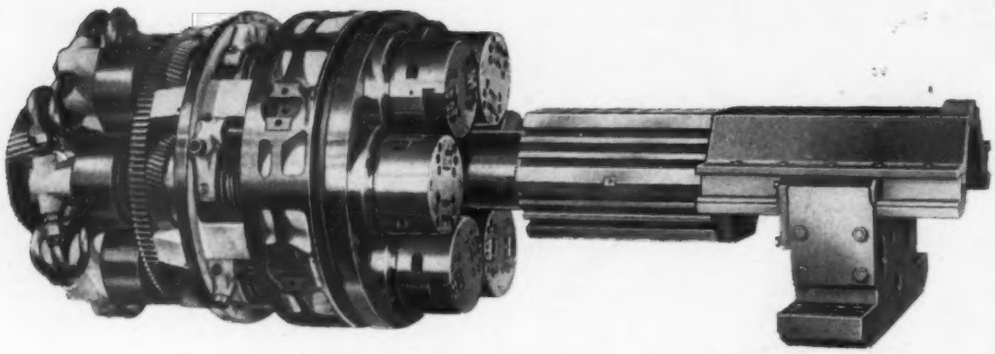
Do not use soapstone, chalk or crayon to layout a sheet for cutting, because these substances leave marks that are difficult to remove and may show up on finished surfaces. Shear blades should be sharp, any burr interferes with draining of enamel, and the enamel will burn off.



Corner Welds. Jigs, as at *A* and *B*, should align the parts accurately, and have sufficient body to carry away heat from the weld. Pressure is applied by C-clamps at points *P*



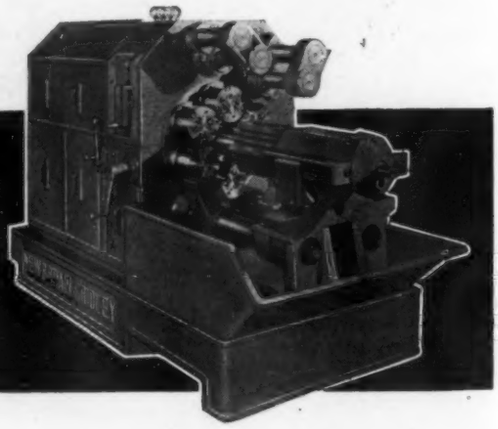
Attachment Devices. If cover coats cannot be brushed away under bolt or screw heads to avoid chipping at assembly, use non-rusting eyelets, grommets or washers to absorb stress



Cradled against wear during index

.....PART OF THE FRAME DURING THE CUTTING CYCLE

The spindle carrier assembly is the very heart of an automatic machine . . . key to its accuracy and dependability. On New Britain Automatics, the spindle carrier is automatically lifted out of contact with the frame of the machine during index. When index is complete it is not only re-seated but clamped to the frame, becoming in effect an integral part of it. This exclusive New Britain feature practically eliminates wear and weave during the cutting cycle . . . assuring the continued accuracy for which New Britains are famous. Other exclusive features provide unmatched speed and accuracy. The sum of them all is PRODUCTION . . . more parts per dollar.



NEW BRITAIN

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT
NEW BRITAIN-GRIDLEY MACHINE DIVISION

M-01028-B

NEWS OF METALWORKING

Price Relief on Capital Goods Starts; Increases Due for Machine Tools

WASHINGTON—OPA's decision to commence decontrol of prices on critical items of capital and consumer goods is beginning to shape in action. This further breakdown of the price line is extensively creditable to pressure from Civilian Production Administrator John Small against the inflexible price policies of Economic Stabilizer Chester Bowles, who still directs the activities of OPA.

Some of OPA's price concessions are based on hardship claims, and some on its new assumption that price increases in capital and production goods would not be immediately reflected in consumer prices and therefore would not strongly contribute to inflation.

Many Rises Granted

OPA has just increased by 4% the ceiling prices of machinery, parts, and industrial equipment in which steel costs total more than 40% of the selling price. The increase is a result of the advance in steel prices authorized March 15, and will pass on to the consumer. It becomes effective immediately.

Producers of cast steel rolls were given a 9% interim price boost. Producers of iron and steel forgings received an increase of 16.25% over their 1941 prices. An interim increase of 12% was granted to producers of steam generating equipment. An increase of 4% was authorized for the producers of steel castings and railroad specialties. OPA revised its regulations covering automotive repair and replacement parts to provide relief in hardship cases and to stimulate production.

Orders, decontrolling prices on low-speed diesel engines and locomotives, and substantial increases on machine tools, dies, jigs, cranes, compressors, and numerous other producers' items, are still expected.

SUPPLIERS' WITHDRAWAL CUTS COAST SHEET STEEL

LOS ANGELES — The current worry over steel have again focused attention of some plant managements on sheet steel supply. With current Western steel plant capacity in the neighborhood of 156,000 tons of sheet a year, and predicted Western needs as high as 700,000 tons, the discussed upping of Western steel plant capacities to a combined sheet production of 300,000 to 350,000 tons annually is still far short of Western requirements.

Sheet steel is the worst bottleneck at the present time and it seems certain to become more so before it gets better, particularly with the withdrawal from the Western market of three of the Eastern plants which served the West. Weirton, Wheeling and American Rolling Mill have all recently announced withdrawal from the Western market. They gave as a reason the recent wage increase, which will make it impossible for them to absorb certain portions of extra costs involved in overland deliveries to the West Coast.

ARMCO Workers Reject CIO

HAMILTON, O.—Employees at the American Rolling Mill Co. plant here have overwhelmingly rejected the CIO as their bargaining agent in a National Labor Relations Board election held here. This was the second time the CIO had been beaten, losing a previous election in Sept., 1944.

Lead Allotments Cut 10% for 2nd Quarter; Subsidy on Imports

WASHINGTON—Amendment of Order M-38, curtailing allotments of lead by about 28,000 tons in the second quarter of this year was in the making as this was written. Civilian Production Administration officials told American Machinist the allotment is being cut to 222,000 tons from 250,000 tons in the first quarter. They said the cut should have been at least 45,000 tons, as the Government's reserve is now down to 30,000 tons.

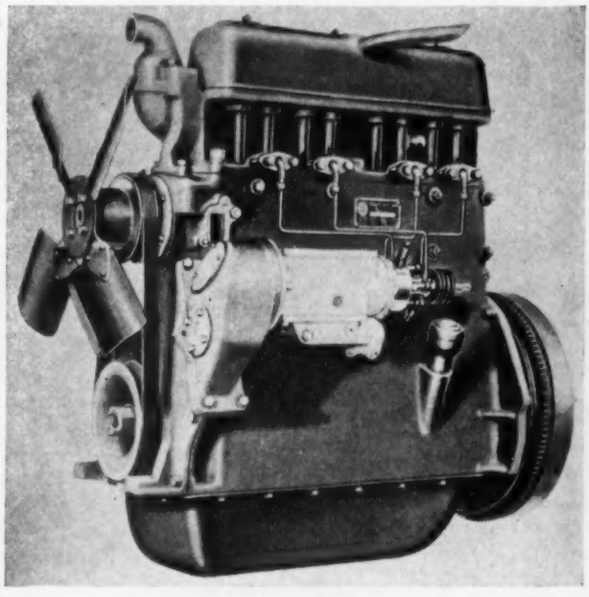
15% Cut on Batteries

Battery manufacturers will have to take a reduction from about 66,000 tons in the first quarter to about 56,000 tons in the second quarter. Tetraethyl is being reduced from 10,000 tons to about 8,000. Paint producers will be extensively denied, as will lead chemicals, including arsenic and type metal.

Contrary to some opinion, CPA officials say, there is no copper shortage; the government has 600,000 tons in its stockpile. Neither is there any shortage in zinc, though cadmium for grills, bearings, etc., is hard to get.

Lead Subsidy

The British are paying 7¢ for lead, as against the U. S. ceiling of 6½¢, but Metals Reserve has met that difficulty by paying 7¢, covering the ½¢ difference out of subsidy, and selling at 6½¢.



Four-cylinder Diesel Engine — Continental Motors is now making a new line of four and six cylinder engines, varying from 25 to 150 hp. The 4-cylinder overhead valve job shown here has a 260 cu. in. displacement and shaft horsepower of 48.5. Size and weight of parts are similar to the auto gasoline engine due to its lower operating pressures obtained with the "Dyna-cell", an hour-glass-like steel bottle in which the unburned fuel is vaporized

Gaging Business

Business Upsets Continue

The periodical reverses that industrial recovery has faced since the end of the war are still far from ended. Despite the general enthusiasm that has greeted the end of each major strike, or clarification of government policy, it now appears that 1946 will witness a continued succession of crises that will provide setbacks of varying intensity to the different segments of industry.

The coal strike is expected to hit the steel industry very quickly. Some steel plants had only a 10 day supply of coal, although the average amount for industry as a whole is a one month supply. Strikes in the nonferrous metal mines are worsening the already critical lead situation. Settlement of these strikes will only mean higher prices for nonferrous metals and coal. This will hit the various metal processing industries, unless they get prompt OPA relief on these new rises in costs. The steel industry has accepted the OPA price relief averaging $5 a ton with misgivings as to its adequacy. Now, higher coal prices will prompt an earlier than had been expected appeal for new price relief in steel.

The upshot means a general rise in prices, despite OPA's hesitancy to grant such relief. Delay in lifting price ceilings has only cost industrial production or diverted it away from some channels into others. Many manufacturers have entirely dropped some lines. Others are abandoning some markets. Several steel companies have announced their withdrawal from the West Coast market, thereby intensifying the shortage of sheet steel in that area. While the government is anxious for the steel industry to produce items that would aid home construction, price ceilings on such items militate against adequate output.

Squeeze on Profits

The OPA's general reticence to grant price relief equalling the higher wages won by organized labor in recent negotiations is squeezing industry's already narrow profit margins. The OPA expects manufacturers and distributors to absorb a good part of higher wage costs. This makes management more conscious than ever of operating costs. It increases efforts to obtain the latest and most efficient production equipment, and forces management to demand greater productivity from its workers.

However, industry's efforts to obtain speedy delivery of new equipment has been blocked heretofore by price ceilings which prevent the equipment makers from employing extra shifts and paying overtime. It is reported that the OPA is conscious of the key position of new equipment in the industrial picture, and that price relief between 10-20% will soon be granted to machine tool makers, and some capital equipment ceilings will be entirely lifted.

Motor Bottleneck Serious

The extended strike at General Electric's plants, now settled, and the continuing strike at Westinghouse have so tangled up deliveries of electric motors that promises now range from 24 to 60 weeks. Current limited shipments are exceeded by new orders, with a steady deterioration in the situation.

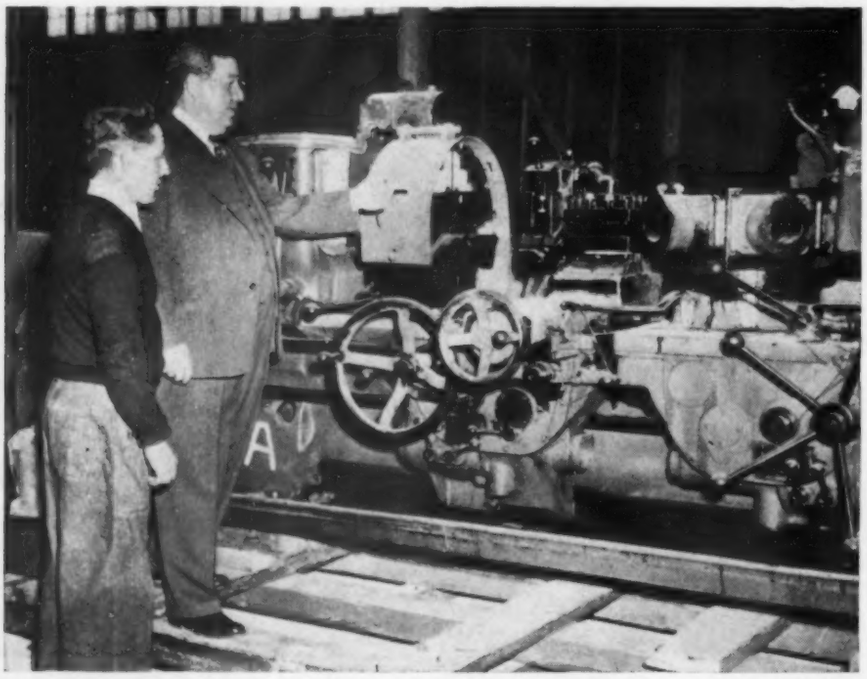
This has so tied up machine tool deliveries that promises of shipment on specific dates are rare. It is possible that the War Assets Administration may step into the breach by dismantling some highly specialized surplus machines and allowing their motors to be sold to equipment builders.

Aside from the motors situation, tool builders are faced with shortages of other parts, including electrical connections, castings and forgings. Presses, shapers, and precision tools are particularly tight.

Strikes Hit Tool Orders

Complete figures for February, indicate that new machine tool business in that month dropped to $21,600,000 from January's $30,600,000. Major reason for the decline is attributed to upset labor conditions during the month, with the shorter month accounting for one-third of the drop. The industry's shipments were slightly affected by strike-caused parts bottlenecks, with February's total falling to $26,940,000 from January's $30,300,000. This limited the industry's progress in reducing its backlog, which was at $173,700,000 at the end of February, as against $178,100,000 in January. The firmness of existing orders was borne out by February's low cancellations of $1,800,000. Foreign business continues to account for about one-fourth of the total volume.

Thus far, some 150,000 machine tools have been declared surplus by the government, and about 35,000 of them have been sold. This is about 30% of the eventual total of 500,000 machine tools expected to become surplus out of government holdings.



Surplus Tool Depot Opened—A War Assets Corp. employee is here shown talking over a surplus turret lathe with a prospective buyer at the Linden, N. J. depot for surplus products opened on March 18th. The depot receives new shipments of surplus items daily, price tags them, puts them on display for immediate sale, five days a week from 9:30 to 3:30

Steel Industry, Facing Coal Squeeze, Seeks to Cut Costs, Raise Efficiency

PITTSBURGH—The steel industry's necessity for picking and choosing its business on the basis of profit margin may collide with government ideas on the subject. Government officials are said to want steel mills to schedule more items needed in construction work. Nails and galvanized sheets are examples of items being produced in limited quantity, contrary to federal plans to promote home construction.

Aside from selective scheduling, managements are forced to demand more work and better workmanship from their employees to help reduce production costs. Unless higher worker efficiency is forthcoming, the industry will have to ask OPA for further price relief.

Some Plants Vulnerable

The steel industry is in a vulnerable position with respect to coal supplies. Coal stocks range from 10 days to four weeks' inventory, but the problems of continuing scrap shortages and mechanical difficulties in charging by-product coke ovens from inventories complicate the situation. The industry's limited scrap supply means that it must continue to use large quantities of iron in the open-hearths, and to make so much iron requires full operation of blast furnaces and keeping them supplied with adequate coke.

On the matter of inventories, many mills would suffer if new coal shipments were halted for an extended time. One large by-product plant obtains its coal from river barges, conveyed directly to the ovens. To obtain coal from its storage piles, the mechanism at this plant is so slow that only 50% operations would be possible without barge deliveries. This not only will slow up the delivery of coke for the blast furnaces, but also that of gas for the open-hearths.

Carnegie-Illinois is said to have inventories of over 300,000 tons of coal, Jones & Laughlin about 250,000 tons.

Any loss of production would probably be diverted into the less profitable items, which would only be in further curtailed production. However, the situation would eventually hit items in heavy production, such as the flat-rolled products. Acute demand for wire products, pipe, and small size bars would be tied up, too.

KAISER-FRAZER TO BUY $27,000,000 OF EQUIPMENT

DETROIT — Kaiser-Frazer's first automobiles will be shipped to dealers in midsummer, according to the company, but the cars will be for display purposes only. Assembly lines are now about 75% completed. Changes in the plans for buying most of the parts from outside vendors are outlined. The company now plans to spend about $27,000,000 for tools and equipment to make its own parts and assemblies. Some of the machinery will be used in vendor's plants. The company also revealed that it is leasing the Douglas plant at Long Beach, Calif. in part for assembling cars on the west coast.

On the financial side, the company contemplates expenditures of $17,000,000 to go for machinery and equipment, $7,000,000 for tools, dies, jigs and fixtures, and $3,000,000 for machinery, tools and equipment for the west coast plant.

End of Coast Machinist Strike Highlights Steel Shortage

SAN FRANCISCO—Machine Shops in the San Francisco Bay area have gone back to work after one of the most melodramatic climaxes to a long drawn-out strike in the nation's labor history. Nor was the end without confusion. The strike, involving 12,000 machinists and about 50,000 other workers who refused to cross machinists' picket lines, began last Oct. 29, and was in its twentieth week when Harvey W. Brown, president of the A.F.L. International Machinists, pulled the stops that set local leaders back on their heels.

Brown Broke Strike

Brown's opponents in the apparently deadlocked situation, were Harry Hook and Ed Dillon, who, as business agents for San Francisco's A.F.L. Machinists Lodge 68, had cooperated with Oakland's C.I.O. Local 1304 in calling the unauthorized strike. The two unions agreed to an edict to employers calling for a "30% raise—or else."

Brown came west to attend the Shipyard Stabilization Conference. He stayed to suspend Lodge 68's charter, to take over bank account and its lodge headquarters, and to sign an agreement with the California Metal Trades Association, negotiators for the shop owners, which gained the strikers an approximate 18% raise. The Oakland C.I.O. group was forced to fall in line.

The back-to-work movement was orderly in a majority of the plants, with a hitch developing when the Bethlehem Steel Corp.'s shipbuilding division refused to open their shops until the government guaranteed an adjustment on contracts because of the added future labor costs. When the Navy promised contract adjustments, work was resumed. Some employers report their forces smaller than before the strike due to (1) machinists who failed to show up because employed elsewhere; (2) inability to get into immediate 100% production.

Steel Worries

With back orders larger than ever before, plant owners feel the boom is here, not only in catching up on lost production and supplying the postwar buyer's market, but because of announced plant expansions and new industries that have come to the area in the last few months, or are coming in the very near future.

Shop operators have one major concern. They are watching the calendar for May 1, the day bids on the Geneva Steel Mill in Utah will be opened by R.F.C. The steel strike brought home to them the west's dependence on eastern steel, even though the price basing point system has been a thorn in their sides for a long time. Stocks here are down and especially so in sheet steel. A few accounts have had their orders cancelled for this type of steel by eastern big steel companies which leaves these western manufacturers holding a great big bag. Some shapes and light plates are also dangerously short.

Geneva A Hope

So manufacturers here using steel are looking to Geneva for the future. They want to see the plant operated so that, with proper freight rates, they can get their raw materials cheaper than ever before. They want to see ample sheet and strip mills in the west, whether at Bethlehem, Columbia, Geneva or Henry Kaiser's Fontana mill.

As to a possible operator for Geneva, opinions seem to favor U. S. Steel, the Department of Justice's Antitrust division and Kaiser notwithstanding.

Surplus Tool Booklet

CLEVELAND — The National Machine Tool Builders' Association has issued a booklet of instruction on "How To Buy Surplus Machine Tools." Besides explaining the salient points of surplus equipment, presenting the Clayton Formula, and the locations of surplus disposal agencies, the booklet stresses that the buyer should, "Go and look at the machine."

War Department, Releasing 105,000 Tools, Says Surplus Job is Going Well

WASHINGTON — Confusion and delay persist in surplus disposal. Even as Gen. Edmund B. Gregory was sworn in to head the new War Assets Administration, the War Department issued a statement which said in effect that the Army is doing its part of the surplus job. Undersecretary of War, Kenneth C. Royall noted in his report the release of much equipment, including over 105,000 machine tools.

Mr. Royall stated that of $9.79 billions of goods declared surplus by the Army, disposal agencies had actually taken off its hands only $1.7 billions. Figures indicating WAA has taken delivery of $6.88 billions are misleading, according to him, because $5.19 billions of the total is aircraft, which becomes WAA's responsibility immediately upon declaration.

The statement complains that the War Department's storage and handling responsibilities are heavy, and it hopes the disposal agencies will take them over as soon as possible. Vast quantities of trucks and other items already declared surplus are standing in public view, and this leads to charges that the Army is hoarding unneeded supplies.

Handling Costs Heavy

A recent survey revealed that the cost of handling screw drivers is 7½c each, probably half their cost, without counting charges for storage and sales. Mr. Royall wonders whether anything at all is realized on such items.

The Ordnance Department alone estimates that the extra handling charges on a million tons of equipment will amount to $70 million. His point is that public funds spent by the War Department for handling declared surpluses should be deducted from receipts.

The Army estimates that two-thirds of eventual surpluses have been declared to date, and that reconversion has not been held up by Army delays in getting machine tools and equipment out of plants.

Mr. Royall energetically denies improper destruction of property by the Army. If anything, he says, the Army is spending too much money preserving property of surplus value.

Reuther, New CIO-UAW President, Plans Wider Action; GM Strategy Revealed

ATLANTIC CITY—Election of Walter P. Reuther as president of the United Automobile Workers, CIO, will result in greater efforts on the part of the union for industry-wide agreements with equalization of wage rates and elimination of differentials.

One of Reuther's major criticisms at the convention here was the practice of individual company or plant bargaining. The 38-year-old union leader also is a strong advocate of guaranteed annual wages and the elimination of piece work. He asserted it was up to the union to make the automobile companies change their marketing practices so as to provide stable employment, eliminating the high peaks and low valleys which prevailed before the war.

Farm Equipment Drive

Reuther charged the administration of R. J. Thomas, defeated president and now vice president, with doing a poor job of organization in the small tool and die shops and the farm equipment plants. This could cause jurisdictional disputes with the farm equipment workers, who are considered a left-wing group. Reuther has openly fought the left-wing group.

The inside story of the CIO United Automobile Workers strategy in the General Motors strike and the divided opinion that existed among the union's top leadership was laid bare here by the Thomas-Reuther feud.

At the same time, R. J. Thomas, union ex-president, advocated better coordination among CIO unions in future strikes. Specifically, he said it was a mistake to have called the GM strike while the flat glass workers were out, thereby relieving ecoomic pressures playing against flat glass producers.

Thomas Ridiculed Reuther

The "ability to pay" theory advanced by Walter P. Reuther, leader of the GM strike, was ridiculed by Thomas as one which would have denied increases to union members in plants such as Ford, Willys-Overland, Studebaker, Hudson, the automotive division of Nash-Kelvinator, and others.

Showing of the "books," about which Reuther made such a point in GM negotiations, would have resulted in a wage decrease, instead of increase, for Ford employees, Thomas said. The ability to pay standard struck at the heart of the union's policy of like pay for like work and would have brought about a chaotic wage structure in industry, "a different pattern in every industry."

Reuther Pleads Publicity

Reuther's defense was that "opening the books" was asked only as part of a public relations program to put GM in a position where it would "have to talk economics," and that Thomas knew the union never expected to see the books.

Thomas charged that Reuther decided to strike GM without awaiting a decision of the union's strategy committee and questioned the "one-at-a-time" policy thus initiated. He also contended that it could have been settled one month earlier on the same terms, which were reached on March 13.

Use of Aluminum as Substitute Aids High-strength Sheet Sales

WASHINGTON—Surplus and new-production aluminum sheet is being substituted extensively for steel sheet, chiefly in construction roofing and siding and in other applications such as drying tunnels, air ducts, etc.

So far as can be learned there is as yet no strong trend to substitution of aluminum alloys in structural members of machines and other equipment.

Plans for aluminum doors, baggage trunk covers, engine hoods, and other movable body parts are under consideration by auto builders. Full development of aluminum structural design in hard goods is not expected until manufacturers satisfy backlog demand for their products and have time for more new models.

Sheet for Sidings

Aluminum Company of America told AMERICAN MACHINIST it is producing high strength heat treated aluminum sheet siding and roofing, both clad and unclad. Clad sheet has a surface of pure aluminum, highly resistant to weather. Unclad sheet requires paint. Both types are delivered flat or corrugated.

Spokesmen for Civilian Production Administration say War Assets Administration, and Army and Navy, are selling quantities of aluminum sheet to be used mostly in construction. It is not feasible to coat surplus stocks, and they must be protected.

ALCOA quotes, for example, $1.35 for a sheet of alclad, flat, 28" by 120", weighing 6.45 pounds. Corrugated is $1.50. Surplus stocks sell at 30% off, which is about the same as new production. Same sheet in 28-gage steel weighing 14 pounds, is 70c in small lots, 56c at mill rates.

Detroit Letter

1947 Models Coming

The "hold the line" policy on 1947 models has been broken. Studebaker has taken the bit in its teeth and smashed the determination of passenger car manufacturers to run through the year without a model change.

Within 30 days, the South Bend corporation plans to have a production line going on postwar cars, 1947 Champions and Commanders. The latter have not been produced in the 1946 models.

Paul G. Hoffman, president of Studebaker, in announcing the 1947 cars to his dealers, did not disclose any details of the new car except to say it would not be merely a design and engineering remodeling job but a complete new line. He has kept well guarded the secret of the sudden changeover.

Others May Changeover

At least two of the passenger car builders have said guardedly that they did not intend to shut down for a changeover this year because of the great demand for new automobiles. Jack Davis, general sales manager of Ford, committed his company to this policy more or less but left a door open for retreat.

In the same manner, A. E. Barit, president of Hudson, made known his company's intentions but not positively. He said he saw no probability of new models for "many months to come." Since there are more than a few months left in the calendar year, he left a path through which he could retreat gracefully if competition got too keen.

GM, Chrysler Doubtful

Other companies have been noncommittal but left the feeling that they would not welcome a changeover before next spring. Two of the Big Three may not join the parade even if competitors should come out with 1947 models before the end of the year. They are General Motors and Chrysler.

General Motors has good reason for not planning a model change. The long strike plus the "sit down" of tool and die makers in the independent shops during the tieup on GM work has put the corporation far behind the parade. It is doubtful if it could get ready in time to have a 1947 model, although plans for one were well along long before the disastrous strike in its divisions.

Chrysler made too many changes in its 1946 line to want to invest in new tools, dies and machines. The only possibility in that corporation is that the light car that is being designed on the possibility that Ford and Chevrolet will have one for the market, will be ready in time.

Model Pressure Growing

Packard has a new line ready but would prefer to keep it out of production until next Spring. But the pressure of competition may force the 1947 model onto the production lines sooner than that. The same holds true for Nash. Willys has ideas but needs much new machinery to get a passenger car on the market.

All in all, it will be an interesting picture to watch develop. With Kaiser-Frazer still promising to start producing in April and the 1947 Studebaker making its bow, anything can happen in the industry.

Auto Output Spurting

The production picture is beginning to look brighter as the GM plants begin turning on their volume. It will be many weeks, possibly June or July, before they catch up on the production they lost during the bitter 113-day strike and the local tieups that have kept most of them idle since the settlement.

But Ford and Chrysler have been stepping up steadily and with the few independents who have been operating, have lifted the total to well over 40,000 units a week. While unbalances remain in supplies and materials, the weekly rate is expected to keep going up from now on in unless other troubles, still unforseen, beset the industry.

Material Situation

Steel is still a troublesome item. The wheel and rim producers are finding it hard to get strip of a quality suited for their output and in sufficient quantities. The prices have been raised considerably but not enough to keep all producers of strip in the field. One large manufacturer said his sources had dropped from seven to four.

GM divisions are expected to get going fast and catch up on their lost volume in quick order, if some balance is restored. Most of the divisions have built up large inventories from their suppliers all during the strike, accepting deliveries right on the spot and getting the suppliers to store it for them or storing it in outside warehouses. The only obstacle to getting into quick production of cars is the dearth of the parts they themselves make. Once they get their parts plants operating, they can turn out a tremendous volume in a short time.

Bodies are one of the principal bottlenecks. Fisher units did not start as a whole, several key plants including the Ternstedt division being kept idle by local disputes. Deep drawing of new-type designs is troublesome.

Best estimates today are that the total production of passenger cars will be around 2,500,000 this year. This can vary one way or another in short order, depending on conditions. Right now the bets are on the optimistic side.

Features of New De Soto—Most obvious changes of the new De Soto are the new radiator grille, wrap-around bumpers, and the fairing of the front fenders into the front doors. This has meant a lot of fine die work. Other features are fluid drive and a new automatic hydraulically controlled gear shift that permits driving without touching gear shift lever or clutch pedal. Brakes have a separate operating cylinder for each shoe. Wheels are 15 inches, with 650 tires. Many new materials are used

Coal, Nonferrous Tie-Ups Threaten Industrial Recovery; Lewis Adamant

NEW YORK—Despite the rebound of steel and automobile production with the ending of the major strikes in those industries, there was one ominous cloud on the brightening industrial horizon in early April: the threat of a new disruption of the nation's industrial machinery by an extended strike of John L. Lewis' United Mine Workers of America, a walkout that would keep 400,000 soft coal miners away from jobs in bituminous mines in 23 states.

Steel Plants Vulnerable

During the shutdown of the nation's steel plants earlier this year management sought desperately to build up reserves of soft coals against the probability that Lewis would lead his miners out of the pits in a bold bid for the most sweeping gains yet made this year by any union for its membership. Despite this precaution, steel men generally see an inevitable decline in production beginning within ten days.

The same situation is found elsewhere in industry. It accounts for the concern in top management offices over just what high strategy cards Lewis has been holding close to his chest. And it accounts for the concern which has been felt, as well, by workers in steel mills, on assembly lines, in all plants where dwindling coal supplies would mean layoffs and more lost pay.

Lewis' Demands High

But Lewis, always chary with tip-offs on his plans, was doubly so this year. His demands were general in nature: more money—but not how much more; a shortened work week; a health and welfare fund financed by mine operators; unionization of foremen and supervisory employees; increased safety precautions, and a series of comparatively minor contract adjustments.

This strategy clearly placed Lewis' opponents at a disadvantage. Result was an operators' offer which topped any made in previous annual negotiating sessions, and which conceivably bettered settlements made this year in other branches of industry. Miners were offered the equivalent of the 18½c hourly raise won in steel, oil, and automotive industries; a jointly-financed fund to mitigate unusual hardships deriving directly from mine accidents; U.M.W. administration of money, collected from workers by employers for medical, hospital, burial, and benefit funds, and concessions on mine safety issues. In return, operators asked for further financial liability by U.M.W. for wildcat strikes.

Industry Offer Rejected

No one, even among the operators, was surprised when Lewis disdainfully rejected the offers, announced his miners planned to "down tools" after contracts ran out at midnight March 31. But there was growing conviction that the operators' offer of about 18½c more hourly had permitted Lewis to shift emphasis from wages to his health and welfare fund as the critical objective.

There was nothing to indicate that operators and miners were sharply split over issues, although at the strike deadline both negotiating parties continued to talk tough and to refuse to retreat from established positions. Neither party wanted government intervention; both realized that it would be inevitable if they could not reconcile their dispute quickly. The nation is not as well prepared for a coal strike as it was in either 1941 or 1945, is wearied of strikes and delays in civilian production. And, over all, both operators and Lewis are keenly conscious of the growing weakness of coal's position in the industrial power field. Neither is anxious to jeopardize in any way coal's competitive strength at this time.

Settling a Billion-dollar strike—Harry W. Anderson (right), General Motors vice-president, talks over settlement of the 113-day GM strike with R. J. Thomas (left), former CIO-UAW president, as Federal Conciliator J. F. Dewey looks on. Bitter issues which prolonged the strike included Reuther's "look at the books" and "ability-to-pay" demands, since disclaimed by him. After the settlement, Henry Wallace disclaimed Commerce figures used by UAW

Nonferrous Impasse

Another extractive industry—nonferrous metals—also has had management on the anxious seat. Strikes by C.I.O.'s Mine, Mill & Smelter Workers and the United Electrical, Radio & Machine Workers by April 1 had shut down 75% of the nation's copper production, and 55% of its lead output. More than 30,000 workers were on strike, and the walkout was spreading faster than a scattering of settlements were being made at 18½c hourly raises. Management apparently was willing to go along with the union on the matter of wages, but not on questions of regional wage parities, union security, and other contract demands. Moreover, confusing pricing and production subsidy reports from Washington made management hesitate about signing new union agreements.

Westinghouse Strike

Only one major strike was listed as continuing during the early days of April, that of 75,000 C.I.O. electrical workers at Westinghouse Electric Corp.

BRITISH MACHINE EXPORTS ABOVE PRE-WAR LEVELS

LONDON—British machinery exports during 1945 averaged $14,900,000 monthly, as compared with the 1938 pre-war average of $19,200,000. January, 1946, machinery exports showed a big rise to $24,800,000, largely due to demands from Russia and the British Empire.

Exports of machine tools alone (included in the machinery total) showed a less favorable comparison. The January, 1946 total of $1,200,000 represented a drop from the 1938 and 1945 averages, both of which were at $1,500,000. However, they did show a recovery from the volume for the last quarter of 1945, which averaged only $900,000.

Washington Bulletin

Nonferrous Mine Strikes

The Secretary of Labor has appointed a fact-finding board in the non-ferrous metals strike, in effect since February 25 in the lead, copper, and zinc industries. The strike is delaying manufacture of batteries and cable sheathing, paint for housing, and other essentials. Strikers are out in mining, smelting and refining operations of the leading companies. The board met in Denver March 25 and will report its findings, which must conform with federal wage and price stabilization policies, within 30 days.

Although Civilian Production Administration officials say there is no present shortage of copper and zinc, it is believed that these metals will soon be hard to get unless the strike is soon settled. Meanwhile, the State Department is insisting that 155,000 tons of tinplate allocated by CPA for export in the year beginning June 1, be allowed to go as scheduled, for use mostly in South American countries for canning food badly needed in European and Asiatic famine areas. CPA wants to retain the tinplate here for conversion purposes, and for canning food, some of which will go to famine victims.

Surplus Head Confident

General Edmund B. Gregory took office as War Assets Administrator, promising that his streamlined organization will dispose of "a substantial part" of the nation's huge war surplus within a year. He expects owning agencies to declare about $35 billion in surplus goods in that period. Gregory takes over in face of a "show me" attitude on the part of the press and large sections of the public, not to mention Congress. Everybody who visits WAA headquarters in Jesse Jones' elegant building notes extraordinary confusion. Undersecretary of War Kenneth C. Royall may be right when he infers that the orderly disposal of war surplus is beyond ordinary human capacity. General Gregory is working against the deadline day when industry will demand curtailment of competition from government stores.

Kaiser Criticized on Steel

CPA Administrator John D. Small practically silenced demands for renewed preference controls on steel when he said that auto-maker Henry J. Kaiser would be able to buy all the steel he needs if not all he wants in the open market. Small said that Kaiser is on equal footing with many other reconverting industries: that there is not enough steel to meet the demand. Small's remark that Kaiser would not need much steel until he gets into mass production, could be applied to many other users who, according to official opinion, are aggravating the shortage by ordering more steel than they need sooner than they need it.

Atomic Bomb Developments

Of all the palaver one reads about atomic bombs and energy, little is good for more than a day. One fact to note is that the Manhattan District has finally agreed to declassify much basic physical data, with approval of the President, which may have industrial value. Firms or persons who were involved in A-bomb research or production, who wish to publicize their accomplishments, or who seek information, can now appeal to Oak Ridge for clearance. For example, piping, valves and fittings having extraordinary corrosion resistance were developed, and may be useful in other applications. Another development was a vacuum pump of huge capacity.

The Navy seems to have lost its battle against unification of the armed forces, with its own Commander-in-Chief, the President, taking sides with Army and the Air Forces in what looks like a feud. Chances are that Congress will not act till after the tests of atomic demolition against ships at Bikini this summer. Seapower advocates are already saying that such tests on ships in harbor will not decide the issue: that results in combat alone will be conclusive. The opposition notes that the admirals sound about the same as they did when Billy Mitchell's aviation sank several warships soon after the other war. However it turns out, there will be a sizeable navy for a long time yet.

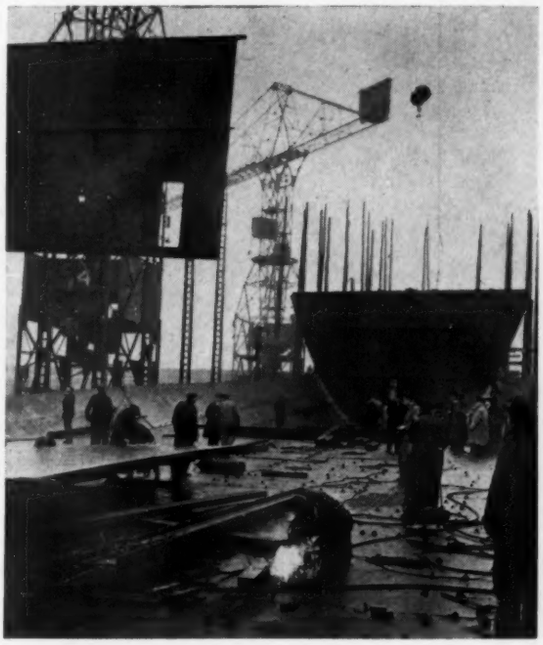
HOUDAILLE-HERSHEY TO MAKE VIBRATION DAMPENER

BUFFALO—A new device to dampen the vibration of crankshafts in automobile engines is going into production at the plant of the Houde Engineering Division of the Houdaille-Hershey Corporation in Buffalo. Indications are that the volume of output will rank close to the output of Houde shock absorbers.

Known as the viscous torsional vibration damper, the device is being used experimentally by a leading automobile manufacturer. It already has been accepted as a production unit by one of the country's largest diesel engine manufacturers.

It was developed by Bernard E. O'Connor, assistant chief engineer, and is one of the first applications of the newly-developed Silicone fluid made by the Dow-Corning Corporation at Midland, Mich.

The device consists of a hollow disc casing which is attached to the end of the crankshaft. Within this casing is an inner flywheel which floats in the viscous fluid. Because of the high viscosity, the inner flywheel rotates at engine speeds.



British Postwar Work on Merchant Ships—Postwar construction of British ships incorporates prefabrication, welding and riveting, capitalizing on war-learned lessons. Work here is proceeding on a 30,000-ton liner at the Vickers-Armstrongs yard at Barrows-in-Furness, England. New methods are estimated to increase carrying capacity of this ship by 2,000 tons

Productivity, Surplus Tool Sales Highlight AMTDA Annual Meeting

CHICAGO—Frank discussion of the problems arising from sales of surplus machine tools, an able address by William P. Kirk, president of the National Machine Tool Builders' Association, an open forum on questions confronting distributors, and a talk on his recent trip to Germany by Mason Britton, president of the Metal Cutting Tool Institute, were features of the twenty-second annual meeting of the American Machine Tool Distributors' Association at the Edgewater Beach Hotel, Chicago, March 25-26. President A. B. Einig, general manager, Motch & Merryweather Machinery Co., Cleveland, presided at all the sessions.

Distributors are "sitting on a hot seat that will approach the melting point this summer or early fall," declared Robert L. Giebel, Giebel, Inc., New York City, in his report as chairman of the committee on surplus property. He emphasized that manufacturers of standard machines are already feeling the competition from surplus stocks and remarked, "we too must eat and we may have to choose between loyalty to our manufacturers and our own bread basket. It is hoped all of us can work out a balanced diet."

Giebel Reports on Surplus

Mr. Giebel reported these recommendations of the Metal Working Machinery Industrial Advisory Committee for improvement in surplus sales procedure:

1. War Assets Administration should furnish approved dealers with a list of plants where machine tools will be available. This creates a demand before a machine is processed and warehoused.

2. All surplus machine tools should bear serial numbers. This is the quickest way in which to learn from the original builder whether the machine is standard or special.

3. WAA field men must learn to distinguish between pattern numbers in castings, serial numbers on motors or control panels or accessory electrical units, and the serial number of the machine itself stamped into the machine by the builder.

4. Machines should not be sold until the sale has been advertised.

5. All branch offices of WAA should be informed that distributors are allowed commissions on "spot sales."

Inspection Permission

6. An accredited dealer should be permitted and encouraged to inspect in advance machines to be offered at spot sales, whether he has a customer with him or not during the inspection.

7. Dealers should be given access to warehouses except when inventory is being taken.

8. WAA should issue rules to cover sales, especially when two buyers want the same machine.

9. Since a customer can ask a dealer to find the machine he wants, the "request to purchase" form should no longer be required except possibly for priority buyers.

10. Machine tools not wanted by the services, by purchasers or by the original builder for rebuilding and not suitable for educational institutions should be scrapped after having been found unsalable by a local advisory committee of machine tool men.

Dealers Complain on WAA

The WAA machine tool branch in Washington, said Mr. Giebel, "is made up" of efficient, experienced and honest men who want to get the job done in the shortest time. Mr. Giebel gave the results of a questionnaire mailed to members from the association office, which showed that 33 members out of 61 responding regard the sales set-up for surplus machines as unsatisfactory and 21 as fair. These opinions were expressed however, during February before recent changes in the set-up were made.

The main task of distributors today is to search out surplus machines which buyers want, because a seller's market is still here, stated R. A. Vidinghoff, Swind Machinery Co., Philadelphia. His company confines its surplus operations to the makes of machines represented in new machine tool sales, (as do most of the association's members). He stressed the current shortage in popular types of standard machines and complained about the lack of information concerning surplus machines in warehouses.

Industry Delays Surplus

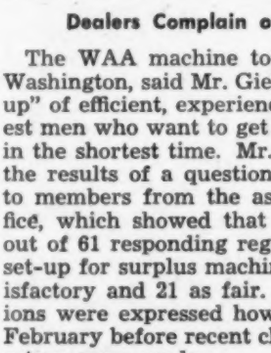
Slowness of manufacturers in deciding what government machines in their plants to retain has been responsible in part for the delay in much surplus equipment coming onto the market, declared W. F. Coleman, dealer surplus machine tool sales, WAA, Chicago. Mr. Coleman cited one large plant which has taken four months to decide what it wants to keep, and even now wants still more time. The Chicago WAA office is urging that all orders be placed at the warehouse and at the plant involved. It will publish immediately a sales manual. Of 188 accredited dealers in the Chicago area, only 40 have made any sales and not more than 20 are attempting to do a thorough job, said Mr. Coleman.

Machine Selling Vital

"Machine tool salesmen are the men who interpret to the experienced designers and skilled mechanics back home in their factories the needs of the busy managements who produce consumer goods," said Mr. Kirk, who is vice president of Pratt & Whitney, Division Niles-Bement-Pond Co., as well as head of the builders' association. "They understand the adaptability of their standard lines and also their limitations, and know when to suggest new or special machines." Machine tool selling, stated Mr. Kirk, never has meant peddling.

If the moral and spiritual world will keep pace with the material world, declared Mr. Kirk, "We are on the brink of a peacetime industrial boom that is beyond our imagination." Many New Dealers have "right-about faced" and are advocating "greater productivity of consumer

Speakers At Recent A.M.T.D.A. Meeting



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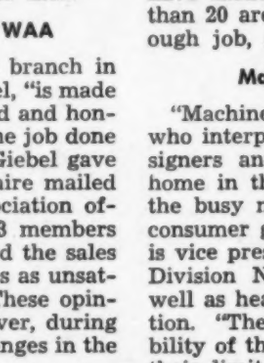

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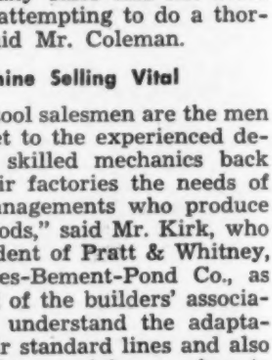


William P. Kirk

goods, to sell at lower prices, made at lower costs in shorter work weeks with full employment at higher wages."

Labor Retards Productivity

Mr. Kirk said that higher productivity means that present models of machine tools must be operated in such manner as to achieve full productivity and that new and better machine tools must be developed which will be capable of still greater productivity. The machine tool industry has a very encouraging future "provided the partnership between men and machines is one of sincere and effective cooperation." The productivity of machine tools and of all other machinery depends upon the attitude and performance of labor. If labor cooperates, everybody wins. But a lot of education is needed to get across this fact to labor.

Leaders of organized labor, pointed out Mr. Kirk, say that they want good wages, low prices and high levels of employment, but they have gone about seeking those objectives by strikes, slowdowns and refusal to use productive equipment to its capacity. "This is like trying to win an automobile race by putting on the brakes. Apparently they propose to assure fair wages by making sure that everyone turns out less work than he used to.

Productivity Makes Jobs

"The surest road toward high-level employment," asserted Mr. Kirk, "is maximum utilization of improved machine tools and other productive equipment. To hold down output is like trying to assure a good bread supply by stunting the growth of wheat. Unless industry can sell the American public, on the fact that increased productivity is the only sure road toward fair wages, fair prices, employment stability and a higher standard of living, you and I one of these days are going to be out of business."

After describing industrial conditions in Germany, Mr. Britton told association members that they must be prepared from now on to do a real selling job again. He urged the association to present its views to Congress and to Washington agencies on all matters concerning the welfare of the industry.

Truck Bookings Doubled

CHICAGO—During the last month of 1945 domestic bookings for electric industrial trucks and tractors totalled 331 units, according to the Electric Industrial Truck Association. The December figure of $1,448,066, which was more than double that of the preceding month, does not include $13,750 worth of cancellations.

Spotting the Air News

Light Plane Research

Decision of the National Advisory Committee for Aeronautics to conduct research on an increasing scale for the light plane industry has important implications. Although NACA's interest in light planes is approved by the Civil Aeronautics Administration, the light plane industry opposes it, on the ground that prospective purchasers will wait for new models having government-sponsored features. Manufacturers can sell all the planes of present design that they can produce.

CAA, Aircraft Industries Association, and Aircraft Owners and Pilots Association have submitted to NACA 41 proposals of features to improve small airplanes. Among these are: reduction of propeller and engine noise; small gas-turbine power plants; jet-driven propeller blades; wing design for faster speeds; 150 h.p. engine weighing not more than 150 lbs.; low flash fuel for protection against fires.

Helicopter Development

Helicopter development is progressing faster than was predicted on conservative authority. Production by Bell and Sikorsky, with more soon to come, is far too expensive for personal use, and too difficult for amateurs to fly. Both of these problems will be worked out in less than the 5 or 10 years previously estimated. The Army is developing a big helicopter for lifting heavy equipment over rivers, etc. It is not entirely foolish to expect rotary wing machines to be used as hoists on some types of heavy construction.

Glenn L. Martin, Consolidated Vultee, and other aircraft designers, are running into extremely high noise levels in using the exhaust of reciprocating engines as jet thrust assist. The amount of thrust obtainable from the exhaust is considerable, and diligent efforts will be made to solve the problem.

Jets and Rockets

Settlement of the General Motors strike will permit Allison to resume delivery of new-model I-40 jet-turbines to Lockheed for the P-80 fighters, which have been using older designs. P-80s have been assigned to Air Force squadrons over-seas.

Development of small model jet engines enables NACA and the Air Forces to fly wind tunnel aircraft models under their own power, giving performance data as well as aerodynamic data.

New Bell Two-Place Helicopter—The new Bell Model 47 helicopter hovers near its Niagara Falls, N. Y. plant. The first helicopter ever to be granted a license by the CAA, the Bell 47 is now in quantity production and about 500 will be delivered this summer. It is equipped with a 175 h.p. six-cylinder Franklin Aircooled engine, uses a two-bladed rotor and gyroscopic stabilizer system. Its gross weight is 2100 pounds, operating speed is 80-miles-per-hour, and it has a cruising range of some 250 miles

E. P. Bullard Relinquishes Presidency of the Bullard Co.

BRIDGEPORT, CONN. — The relinquishing of the presidency of The Bullard Co. by E. P. Bullard to become chairman of the board points up the career of this well-known machine tool manufacturer and pioneer in industrial education. Mr. Bullard will be succeeded by his nephew, E. C. Bullard, who has served as vice president and general manager of the firm for the past 15 years.

E. P. Bullard joined the firm founded by his father as an apprentice in 1892 and subsequently served as draftsman, assistant superintendent, foreign representative and general manager before being elected president in 1907, following his father's death.

E. P. Bullard

During his years in the machine tool business, he was granted more than 60 patents and was twice recognized by national honors. In 1920 the Howard N. Potts gold medal was conferred upon him by the Franklin Institute of Pennsylvania for his development of the automatic machine tool now known as the Mult-Au-Matic. Seven years later the American Society of Mechanical Engineers presented him with its medal for "outstanding leadership in the development of station-type machine tools."

Established Trade School

Mr. Bullard was president of the National Machine Tool Builders Association for a two-year period from 1911-13. His election followed his work as chairman of the apprenticeship committee of the association. It was after that that he was instrumental in establishing a trade school in Bridgeport, which was renamed in his honor in 1944.

The new president, E. C. Bullard, served his full apprenticeship in the Bullard shop before enlisting in the Army during World War I. After the war he worked in almost every department of the firm before being named production manager and elected to the board of directors in 1930. Since April, 1931, he has been vice president and general manager of the firm. As operating head of the plant, he directed and coordinated the manufacture of many products strange to the machine tool field, during the second world war when the plant had its greatest expansion.

E. C. Bullard

E. C. Bullard has also been responsible for many progressive steps taken in employee relations, the newest of these being the installation of a retirement income plan.

In 1941, he served as treasurer of the N.M.T.B.A.

NEW CONSTRUCTION AND EXPANSION

American Brake Shoe Co. plans a $12,300,000 improvement and expansion program for 1946 which will include seven new plants. Five of the plants will be foundries—a brake shoe plant, one for special iron castings, one producing alloy steel, and two non-ferrous foundries — while the other two plants will be non-metallic processing plants, one in the U. S. and one in Canada. Enlargement of the air compressor plant is also planned.

The Emerson Electric Manufacturing Co., St. Louis, Mo., has leased a modern plant at 8100 Florissant Ave. from the RFC which will permit an enlarged production program. All operations will be consolidated at this location and the move is scheduled for completion by September.

E. I. duPont deNemours & Co., Wilington, Del., is embarking on a major postwar expansion program involving the construction of 35 new projects "aimed at discovering new processes and projects."

The Reliance Electric & Engineering Co., Cleveland, will build a modern plant in Astabula, Ohio, to cost $750,000. Installation of machinery and equipment is expected to cost an equal amount. The new plant will be used for the production of 1 to 15 hp. electric motors and variable speed drives.

The Glenn L. Martin Co., Baltimore, Md., will build a $1,500,000 plant to manufacture its Marvinol resin, a new elastic plastic. The plant will be operated by the firm's Plastics and Chemicals Div.

Ford Motor Co. has reacquired its branch plant at Norfolk, Va. and $1,500,000 will be spent on plant modernization and new equipment.

The Buffalo Tool & Die Manufacturing Co., Buffalo, N. Y., has purchased a building on the former Pierce-Arrow property for expansion.

Bridgeport Brass Co., Bridgeport, Conn., has started a two year plant modernization program which will cost more than $5,000,000.

Century Manufacturing and Instrument Co., Tulsa, Okla., has started building a new research and development laboratory. The building will be one of several to be constructed by the firm and its associate company, the **Loveless Manufacturing Co.**, and will represent an investment of $200,000.

The Metal Goods Corp., St. Louis, Mo., will build a $1,000,000 plant in Houston, Texas.

Belden Manufacturing Co. will spend approximately $1,150,000 on additions to the Chicago and Richmond plants. More than $800,000 will be expended in 1946.

Brace-Mueller-Huntley, Inc., will build three new warehouses in Buffalo, N. Y., this year, which will cost about $500,000. The firm is spending an additional $250,000 for expansion at Syracuse, N. Y.

R. G. Wright & Co., Inc., Buffalo, N. Y., has purchased the former **Barber Asphalt** plant to care for future expansion. $100,000 is being spent for the property and necessary improvements.

Pratt & Lambert, Inc., Buffalo, N. Y., will spend $325,000 for expansion of its plants in various parts of the country. Nearly one third of the sum will be for machinery.

Canadian Auto Output Small; Studebaker Joining Producers

OTTAWA—Handicapped by labor troubles and shortages of parts and equipment, the automobile industry has been slow in swinging into production. From November 15 (date of the order authorizing passenger car production) to the end of February, Ford had shipped only 544 cars, Chrysler 2,904, and General Motors 1,818. Truck production was also disappointing at 8,984 shipped for the six months period, in contrast to 24,693 for the pre-war year of 1939, and the wartime output of 214,704 in 1942. Shipments for the latest interval were: General Motors 2,590, Chrysler, 3,556, Ford, 1,504, and International Harvester, 1,334.

Since Canada has over 1,000,000 passenger cars registered, practically all over five years old, the industry faces years of capacity business. But it has a long way to go to get back to its 1940 peak of 101,000 cars.

U. S. Strikes Felt

Ford was the only one of the three Canadian concerns to suffer directly from labor troubles. Its small output reflects the prolonged strike at its Windsor plant. General Motors had to close down its Canadian operation because of the strike at the American plants which shut off its parts supplies. The U. S. steel strike affected all three and its aftermath is still felt.

Studebaker Plans Pushed

The first serious postwar invasion of the Canadian automobile industry is the entry of Studebaker Corp. of Canada, which has purchased for $500,000 a former government war plant at Hamilton, Ontario. Kaiser-Frazer, Nash and Willys-Overland interests have also indicated plans to establish Canadian subsidiaries.

Studebaker's new 300,000 sq. ft. plant will give it the most modern automobile producing facilities in Canada, according to D. C. Gaskin, vice president and general manager. Plans call for the import of motors from the Studebaker plant at South Bend, and purchase of the frames from the National Steel Car Co. at Hamilton, which has been making frames for some time, and which is within trucking distance to the Studebaker plant. The government is now removing its machinery from the plant, and an early start will be made in installing Studebaker equipment so that operation can be started.

Kaiser Received Most RFC Aid

WASHINGTON—Kaiser interests received more than one-third of total RFC loans to business up to Feb. 28, 1946. Of total loan of $286,653,000 outstanding on that date, Kaiser interests held $103,268,200.

Names in the News

John S. Leslie

Charles Gross

John S. Leslie, vice president and general manager since 1943, has been elected president of Leslie Co., Lyndhurst, N. J. **S. Inglis Leslie,** who has been president for the past 20 years, has been named chairman of the board. He was formerly secretary and treasurer of the concern. John Leslie joined the organization in 1936 and four years later became vice president. In 1943 he assumed the additional duties of general manager.

Charles Gross has joined Aeronautical Products, Inc., Washington Court House, Ohio, as vice president in charge of sales. He was recently general sales and advertising manager of the Murchey Machine & Tool Co., Detroit.

E. R. Galvin, formerly president of the Tyson Bearing Corp., Massillon. Ohio, is now executive vice president, general sales manager and a director of LaPlant-Choate Mfg. Co., Cedar Rapids, Iowa.

W. C. Swalley has been named vice president in charge of sales of the Wellman Engineering Co., Cleveland.

Irving A. Hecht has been appointed general sales manager of Willey's Carbide Tool Co., Detroit.

R. R. Moore has been elected president of the recently re-organized Hall-Scott Motor Car Co., Berkeley, Calif. Other officers include: **V. C. Schorlemmer** and **W. E. Henderson,** vice presidents; **R. B. Watts,** secretary; and **M. A. Hardie,** treasurer; Mr. Henderson was appointed acting general manager of the firm.

Harry Wilson, Jr., formerly vice president in charge of operations, has been elected first vice president of the Jessop Steel Co., Washington, Pa. He has been with Jessop for 40 years.

W. Art Mankey has been appointed assistant to the president of Ryan Aeronautical Co., San Diego, Calif.

George L. Todd, executive vice president, has been elected president of Todd Co., Inc., Rochester, N. Y., succeeding **Walter L. Todd,** who has become chairman of the board.

Paul Abel, formerly assistant chief engineer of The Yoder Co., Cleveland, has been named chief engineer to succeed **G. E. Kentis,** resigned. During the war he was in charge of Yoder's gun and shell production.

Ferd Luyben, formerly tool superintendent of International Harvester Co., Fort Wayne, Ind., is now works manager of Weddell Tools, Inc., Rochester, N. Y.

John Smyly has recently been appointed general sales manager for the J. M. Dalglish & Co., St. Paul, Minn. Before joining Dalglish two years ago, Mr. Smyly had been associated with various divisions of General Motors Corp.

John Smyly

J. A. Wagner

J. A. Wagner has been elected vice president and manager of Sommer and Adams Co., Cleveland subsidiary of The Federal Machine & Welder Co. Mr. Wagner was formerly vice president of engineering and sales of the Advance Tool & Die Co., Detroit.

Theodore G. Hughes has been appointed factory manager of Norma-Hoffman Bearings Corp., Stamford, Conn., succeeding **P. Butchard,** who has been filling the position temporarily.

P. J. Patton, Jr., has been appointed middle western regional manager of the Industrial Div., Ransome Machinery Co., Dunellen, N. J., with offices at 400 West Madison St., Chicago.

Sigmund A. Czarnecki has been appointed production engineer for Hamilton Standard Propellers Div., United Aircraft Corp., East Hartford, Conn.

H. L. Grapp has been elected president and general manager of the Despatch Oven Co., Minneapolis, Minn., to succeed his father, **A. E. Grapp,** who has been named chairman of the board. Other officers include: **F. H. Faber,** vice president and general sales manager; **G. M. Lund,** vice president and secretary.

R. J. Swing has been appointed general manager of The Bunell Machine and Tool Co., Cleveland.

OBITUARIES

Edward J. Finkbeiner, 60, vice president of American Car and Foundry Co., New York City, died suddenly March 23. Mr. Finkbeiner had been associated with the company for 42 years.

Frank Parker, 56, chairman of Iron & Steel Products, Inc., Chicago, which he founded in 1930, passed away March 17. Prior to 1930, he was president of the Railway Car and Equipment Corp., Chicago.

Clayton A. Nenno, 58, passed away March 18. Mr. Nenno, nationally known in the metal industry, resigned five years ago as executive vice president of J. M. & L. A. Osborn Co. He was also founder and president for five years of the Nenno Metals Co., Buffalo, N. Y.

August L. Schultz, 63, experimental engineer for the Addressograph-Multigraph Corp., Cleveland, for the past 26 years, died suddenly March 10.

Jacob W. Buller, 77, founder of the Buller Manufacturing Co., Hillsboro, Kan., died March 12.

Joseph F. Cunningham, 62, purchasing agent for the Superior Foundry Co., Cleveland, for the past 26 years, died March 9.

BUSINESS ITEMS

The **B. F. Sturtevant Co.,** purchased by **Westinghouse Electric Corp.** last Sept., will be integrated with the facilities of the Westinghouse Air Conditioning Div. which has been transferred from Jersey City, N. J., to the main Sturtevant plant at Hyde Park, Boston, Mass. The division will be known as the **B. F. Sturtevant Co., Div. of Westinghouse Electric Corp. Ellis L. Spray,** Westinghouse vice president in charge of the Elevator and Air Conditioning divisions, has been named executive vice president of the new organization. Also, **G. C. Derry,** formerly vice president of the Sturtevant firm, has been elected vice president and general manager.

Geroter May Corp., Baltimore, Md., has named **Battersby, Hendee & Prentzel,** Philadelphia, as its representative in that territory for Geroter air and hydraulic valves and cylinders and hydraulic pumps.

Weddell Tools, Inc., Rochester, N. Y., has consolidated its sales and manufacturing departments and moved to 37 Centennial St.

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has opened a new branch office at 1607 Industrial Trust Bldg., Providence, R. I. **R. H. Porterfield** has been appointed manager of the New England district.

Willamette Iron & Steel Corp., Portland, Ore., has been purchased by the **Guy F. Atkinson Co.,** San Francisco.

Geary Stainless Steel Co., 15 East 21 St., Baltimore, Md., has been formed by **Edward P. Geary,** formerly assistant vice president in charge of sales of The Rustless Iron and Steel Corp. The new concern, which will handle the sales of stainless steel in all forms, also has a branch office in Chicago at 333 N. Michigan Ave., under the supervision of **Robert L. Springer.**

Fawick Airflex Co., Cleveland, has opened a New England sales office under the direction of **Stanley T. Johnson,** care of The Transmission Engineering Co., 102 St. Mary's St., Boston, Mass.

The Barium Steel Corp. has acquired control of the **Central Iron & Steel Co.,** Harrisburg, Pa.

Forks Tool Manufacturing Co., Inc., has been formed in Buffalo, N. Y., by **Richard H. Schneider, Everett K. Tole** and **Jacob Pelloth.**

The **Harrison Radiator Div., General Motors Corp.,** took over the **General Cable Corporation's** Buffalo plant April 1.

National Electric Products Corp. has moved its general offices to the Chamber of Commerce Bldg., Pittsburgh.

The **Heating and Ventilating Div., Evans Products Co.,** Detroit, has been renamed the **Thermo-Aire Div.**

Modernair Corp., Oakland, Calif., has been formed by the consolidation of the **Rucker-Vaughn Co.,** Oakland, with **Modern Products, Ltd.,** Los Angeles. The firm will produce cylinders, valves, filters, lubricators, and a new air-operated chuck. **Clark E. Rucker** and **Clifford S. Vaughn** of the Oakland concern are president and secretary, respectively, while **John E. Goldring** of Modern Products is vice president.

The **Waltham Grinding Wheel Co.,** Waltham, Mass., has opened a factory branch in Chicago at 114 N. Des Plaines St., under the management of **E. S. Avery** to cover Ill., Ind., Wis., Minn., Mo., and western Mich.

Henry Manufacturing Co., Topeka, Kan., has been formed to manufacture road and farm machinery. **Albert Henry, Jr.,** has been named resident agent, while **Albert Henry, Sr.,** will serve as president and **Bernard W. Nelson** as vice president.

The **Misener Manufacturing Co.,** Syracuse, N. Y., will move to 200-208 Walton St.

Manzel Brothers Co., Buffalo, N. Y., has been purchased by the newly formed **Frontier Industries, Inc.,** of that city and will be operated as a subsidiary.

MEETINGS

American Management Association. Production management conference. Hotel Pennsylvania, New York, N. Y. April 22-24. American Management Association, 330 West 42 St., New York 18, N. Y.

American Society of Tool Engineers. New Era Exposition. Cleveland Public Auditorium, Cleveland, Ohio. April 8-12. C. V. Briner, president, 1666 Penobscot Bldg., Detroit, Mich.

Machinery Dealers' National Association. Annual convention. Claridge Hotel, Atlantic City, N. J. May 29-31. R. K. Vinson, executive director, 20 North Wacker Dr., Chicago 6, Ill.

National Machine Tool Builders' Association. Spring Meeting. Hotel Ambassador, Atlantic City, N. J. April 15-17. Tell Berna, general manager, 10525 Carnegie Ave., Cleveland 6, Ohio.

Society of Automotive Engineering. Semi-annual meeting. French Lick Springs Hotel, French Lick, Ind., June 2-7. John A. C. Warner, secretary and general manager, 29 West 39 St., New York, N. Y.

Society of the Plastics Industry. National Plastics Exposition. Grand Central Palace, New York, N. Y. April 22-27. W. T. Cruse, executive vice president, 295 Madison Ave., New York 17, N. Y.

Shop Equipment News

LeBlond Postwar Crankshaft Lathes Emphasize Fast, Automatic Operation

Production of automatic crankshaft lathes by the R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio, has been resumed with four machines that are said to be more automatic and much faster than the models produced by LeBlond before the war.

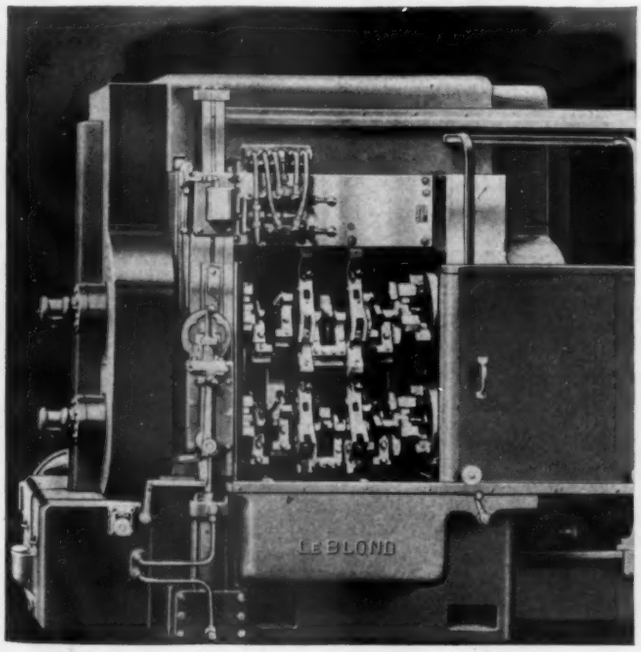
Included in the new line are the 6AC for rough or finish turning all pin bearings, the 7ACL for rough turning all line bearings, the 1LB for rough and finish turning of line bearings, and the DM for finish turning of line bearings.

For pin bearings, the 6AC is a 2-spindle machine that will simultaneously rough or finish turn pin bearings on both spindles. Drive is from both ends in hydraulically operated pot-type chucks. Two master crankshafts pattern the movement of the tools through the cycle of rapid traverse to start of cut feed movements to the sizing stop, and rapid return to starting position. Variation of feed on any part of the cut is possible through predetermined design of the cam. The spindle can be stopped at any predetermined position. The control circuit is interlocked with chucking valve. Average production is estimated at 30 to 50 cranks per hour.

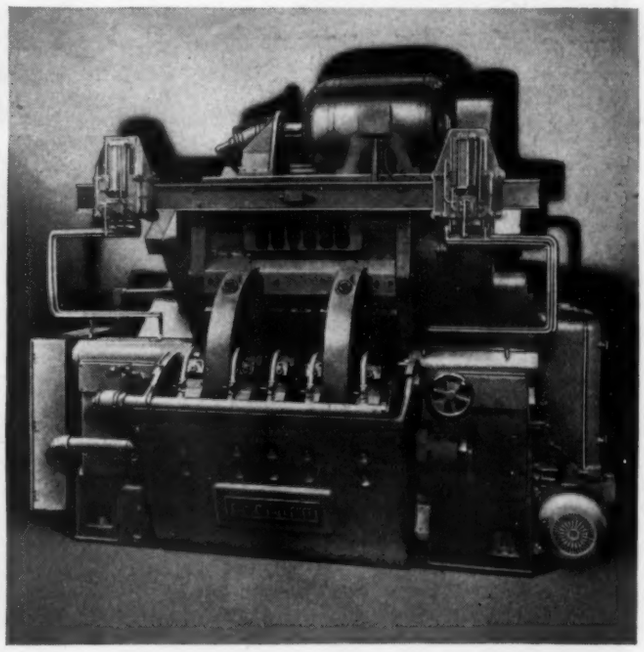
For rough turning line bearings, the 7ACL has a single or double center drive and will rough turn all line bearings in one operation. Driving head and tools, as well as mechanical feed, are electrically powered. Dwell is provided at the end of the cut to remove rough tool marks. The machine is equipped with an air-operated carrier crane for handling crankshafts in and out of machine. Average production is 15 to 25 cranks per hour.

Separate sets of tool units simultaneously rough and finish turn all line bearings, flange and stub ends of crankshafts in the 1LB which has either single or double center drive. Two sets of oppositely moving cutting tools rough out all line bearings, followed by another set of tools which moves in from a third direction for finish turning. There is no loss of time between roughing and finishing operations. The finishing tool unit provides positive, smooth dwell of pre-determined duration for sizing the work, contains the coolant system, and acts as chip guard and apron for protection of operator. The lathe is powered by combination electric-hydraulic motor units, controlled by readily accessible electric push buttons which in turn control limit switches, solenoids, and electric relays and contactors. Average production is 12 to 20 cranks per hour.

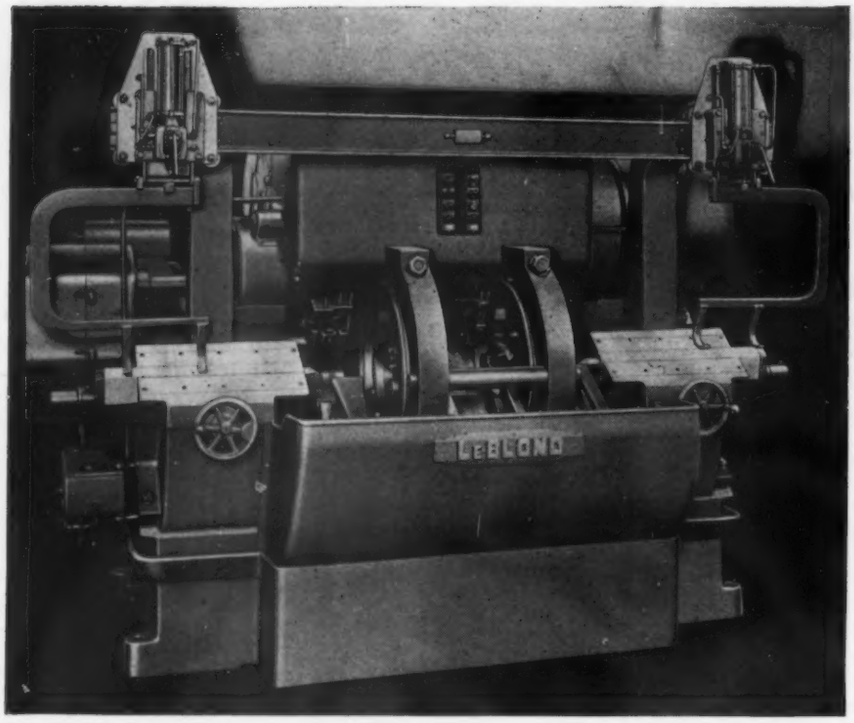
For finish turning line bearings, the DM is a four-station indexing machine built on the revolving drum principle. Eliminates completely all



The 6AC LeBlond Automatic Crankshaft Lathe has two master crankshafts, enlarged duplicates of the crank to be machined, which pattern the movement of tools on lathe's two spindles



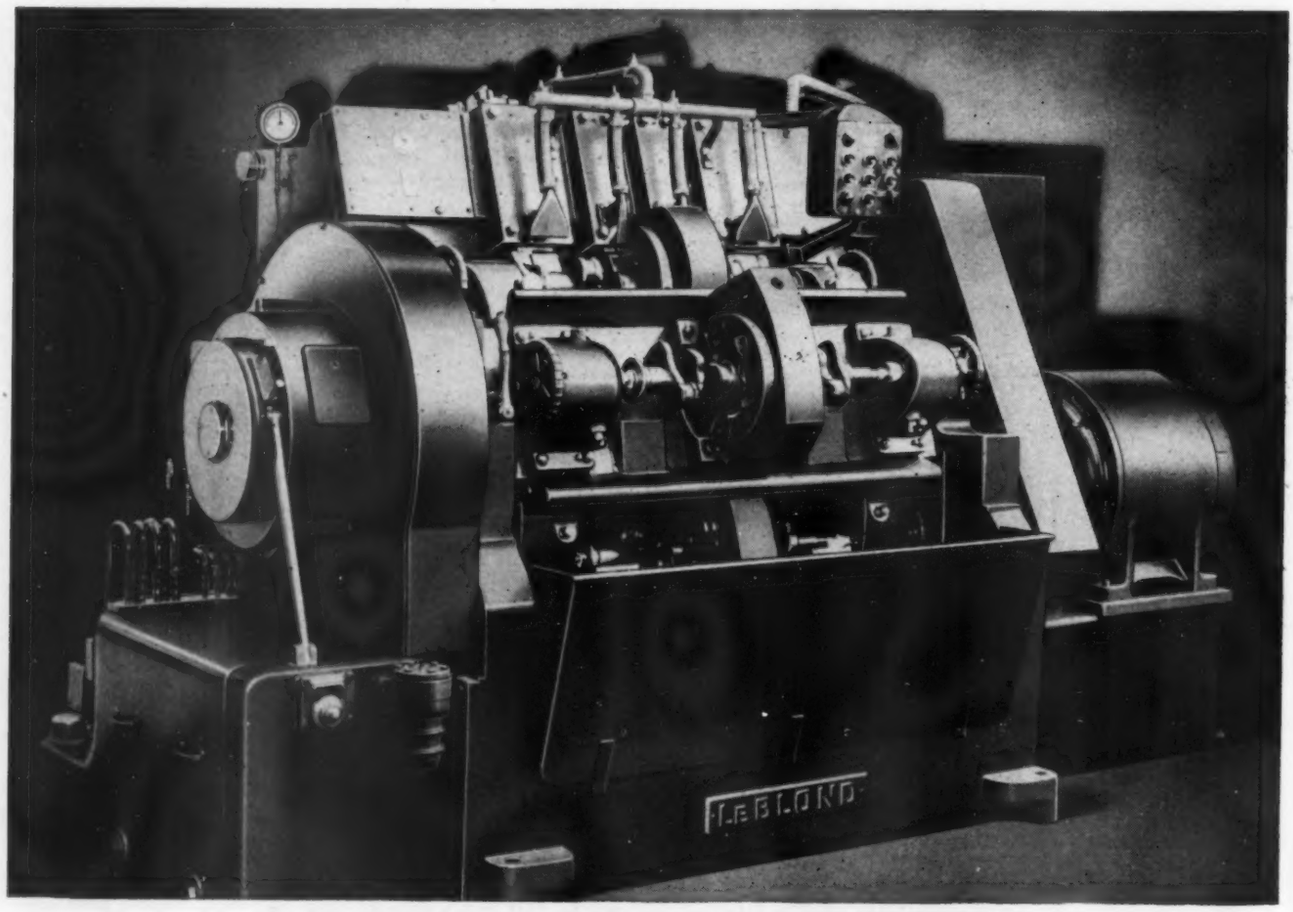
In the 1LB Lathe, separate sets of tools simultaneously rough and finish turn all line bearings, flange and stub ends of crankshafts. Either single or double center drive may be used



The 7ACL for rough turning all line bearings in one operation has an air-operated carrier crane for handling crankshafts in and out of the machine

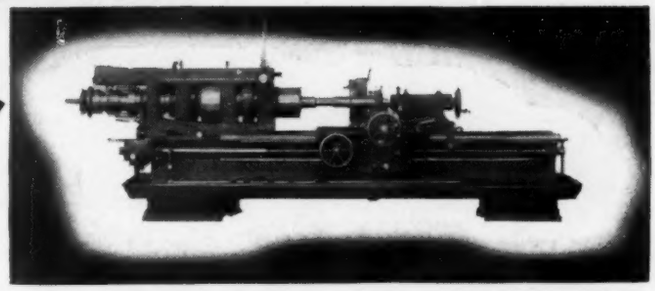
rough grinding operations. The addition of the fourth station, used for loading, makes possible continuous uninterrupted operation of the machine without time formerly lost for loading and unloading. The lathe is powered by combination electric hydraulic motor units, controlled by readily accessible electric push buttons. Equipped with red and green control light system which not only protects operator, but also gives a visual check of the progress of the work. A large number of separate cutting operations combine in a complete cycle, increasing the productive capacity of the lathe. Average production is estimated at from 30 to 40 cranks per hour.

These four machines have a small amount of overlap in their functions but generally complement one another to provide for all phases of rough and finish turning of line and pin bearings on automotive crankshafts. Pin bearings are both rough and finish turned on the 6AC, while line bearings may be done on either the 1LB or on the 7ACL and the DM machines.



Using the revolving drum principle, a loading station has been added to the Model DM to permit continuous operation of the crankshaft lathe

ON WHICH LATHE IS YOUR ... PROFIT BIGGER?



You may have become so accustomed to "Old Faithful" that you overlook its limited profit possibilities compared to a modern, high-speed tool.

For instance, the "old 1920 lathe" above is limited to a few feeds and single tools. Makeshift attachments may improve output slightly. Newer carbide tools cannot be used because of lack of rigidity and limited horsepower. If 1920 production costs were the same today, this lathe would still be too old, worn and inefficient to operate at a profit.

Compare this machine with the new 2A Duomatic (left) the lathe with a "man inside". Completely automatic, any unskilled operator turns out work by the thousands. Dual tool slides, front and rear, operate singly or together—make it like two lathes in one. Performs the widest variety of multiple tool jobs, quickly set-up by simple mechanical adjustments —no cams to change cycles.

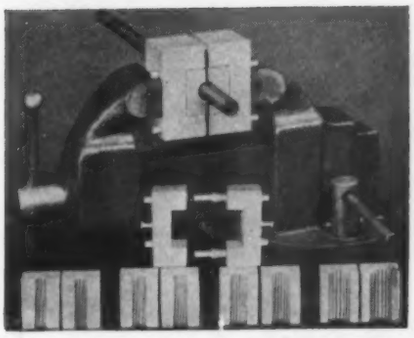
An L & S Engineer will show you how much more profit this new lathe offers you. Write on your Company letterhead for Bulletins Nos. 601 and 620.

THE LODGE & SHIPLEY MACHINE TOOL CO.

L & S LATHES

CINCINNATI 25, OHIO, U. S. A.

MACHINE TOOL DIVISION 3055 COLERAIN AVE. • SPECIAL PRODUCTS DIVISION 800 EVANS ST.



Nip-Grips consist of two retainer blocks with hardened steel removable inserts to hold the pipe

Campbell Nip-Grip Blocks Fit Any Machine Vise

A pipe-gripping device has been designed by J. A. Campbell Co., 645 E. Wardlow Rd., Long Beach 7, Calif., to hold small pipe in any vise without crushing or marring surface or threads. Known as Nip-Grip, it permits fast handling of pipe without damage. Consists of two light-alloy retainer blocks in which hardened-steel inserts are slipped to hold pipe of different sizes. Inserts of ⅛, ¼, ⅜, and ½ in. are furnished. Springs automatically spread the blocks apart when the vise is opened. Holder can be positioned horizontally or vertically and is held by pins.

Automatic Liquid Cutoff Valve Prevents Air-Bound Lines

The V-202 automatic liquid-cutoff valve produced by Johnson & Jennings Co., Cleveland 14, Ohio, is for mounting on the outlet line of a storage tank. It operates on a balance principle and closes automatically to prevent the introduction of air into the line. Weighting of the preloading chamber can be varied for different tank levels and additional weight can be put on top of the lower diaphragm, if desired. All parts are accessible for inspection, and the indicator, which shows whether the valve is open or closed, is hooded to keep out dirt and grit. Valves are built with iron bodies, aluminum valves, fitted with non-metallic seating rings and steel stems. Although 2-, 3-, 4-, and 6-in. sizes are standard, others can be furnished.

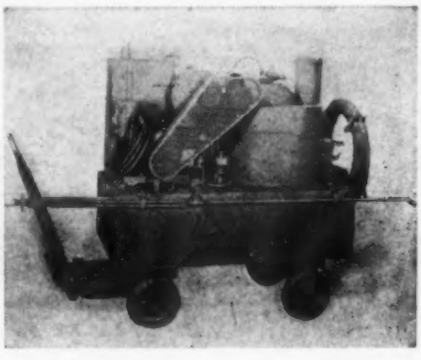
If necessary, the indicator can be hooked to operate a remote indicator and thus permit control of pumping operations for multiple tank installations from one control station.

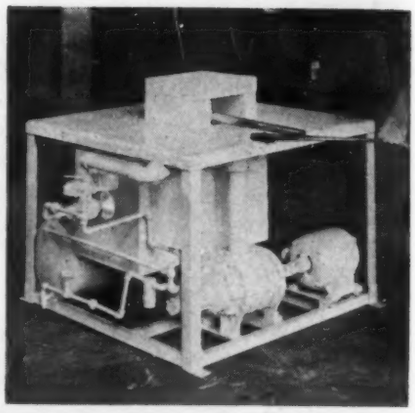
Rubber Lined Filter Tank Protects Sparkler Filter Unit

Model 8-18 plating solution filter, manufactured by Sparkler Manufacturing Co., Mundelein, Ill., has been designated bright nickel plating solutions. The tank is rubber lined.

Pressurized Cleaning Solutions Delivered by Oakite Generator

Portable, oil-fired, enclosed coil-type steam generator manufactured by Oakite Products Inc., Thames St., New York 6, N. Y., delivers hot vaporized cleaning solutions under pressures up to 200 pounds for removal of grease and other deposits from surfaces. No. 1, No. 2, or No. 3 fuel oil, kerosene, or gasoline may be used to operate the unit. Power for driving mechanical parts is provided by one electric motor, which operates on 110/220-volt single-phase ac. Because of its flexibility of steam pressures, the equipment may be used for many different types of light and heavy-duty cleaning. All moving parts are enclosed and the unit operates without vibration.





Position of the fire-block in the worktable permits insertion of long bars for center heating

Diamond Metal-Heating Forge Uses Lighter Fuel Oils

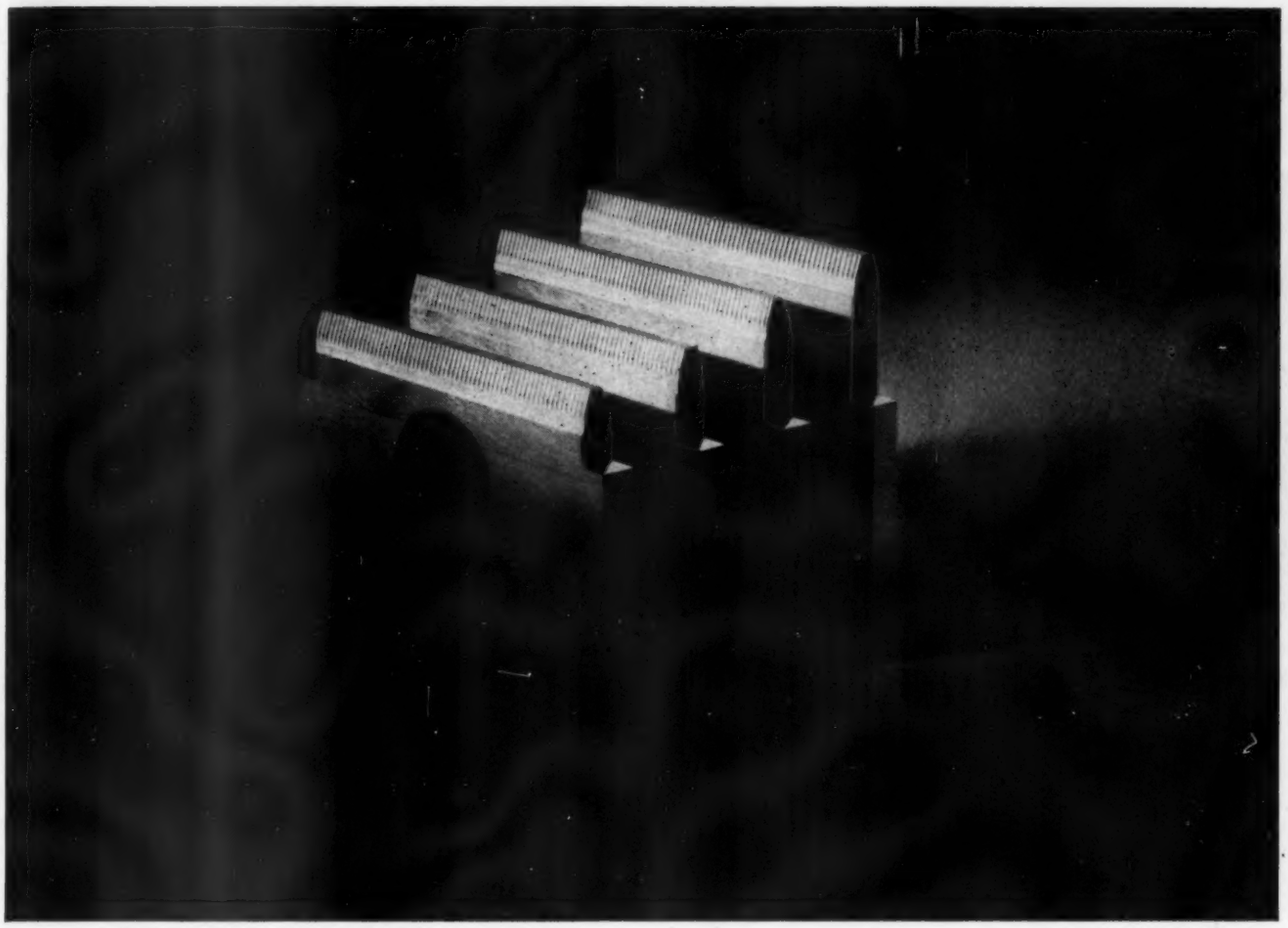
Diamond Iron Works Inc., Minneapolis 11, Minn., is the manufacturer of a metal heating forge which has a fuel supply tank, pump, motor, blower, burner and combustion chamber combined in the unit. Heat is concentrated at the table work opening and pieces can be heated on end, center, or where needed.

Broken Saws and Thin Files Used in Super Blade-Holder

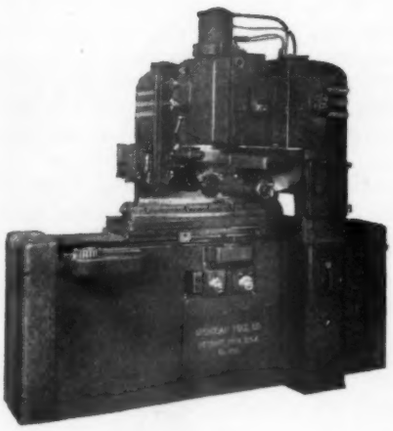
To utilize broken lengths of hacksaw blades and thin flat file sections, the Super blade holder is announced by A. D. McBurney, 939 W. 6 St., Los Angeles 14, Calif. Holder is a tubular handle with an extended positive-grip nose to secure working point of a blade or file. Ends of handle are slotted to receive inserted blades of different lengths. Can be used as a handle for old blades which have been ground for use as knives or scrapers.

Sensitive Thermocouple Ends Protected by Cast-Iron Tubes

Cast-iron thermocouple protecting tubes, manufactured by Minneapolis-Honeywell Regulator Co., Wayne & Roberts Ave., Philadelphia, Pa., have a uniform wall thickness to within plus or minus 1/32 in. They are cast with both ends open, permitting positive support for the core at each end. One end is closed with a cast-iron plug, welded in place with a cast-iron filler rod; the opposite end threaded for a 1-in. standard pipe. Inside diameter is 13/16 in., outside diameter 1⅜ in., wall and minimum top thickness, 9/32 in., weight, 4.5 lb.



"TOOL COST LESS THAN 1/2 CENT PER GEAR FINISHED"



That is the story of a typical MICHIGAN rack type gear finisher. On this rack about one and one-quarter million gears were finished. About 40,000 gears were produced per sharpening—an "average" performance figure for rack type shavers. The rack was sharpened eight times before requiring re-serrating. It was re-serrated four times—giving a total of 32 sharpenings.

Above are shown four rack blades representing the history of this rack. At the right, a new blade is shown. At left, after the last re-serration—still good for 320,000 helical (9.25 Pitch) gears.

Where high production of accurate gears is the order of the day, there is no substitute for the MICHIGAN 900 rack type shaver as to tool cost per piece.

For further information, write for Bulletin 900-45.

ORIGINATORS of GEAR SHAVING

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS ROAD DETROIT 12, U. S. A.

Thermex Dielectric Heater Has Portable Equipment

All operating equipment of the Thermex Dielectric heater is inclosed in the wheeled steel cabinet

Portable Model 88 x 0 Red Head Thermex high-frequency dielectric heating unit, a product of The Girdler Corp., Louisville, Ky., has an output of 5 kw. delivered at 20 megacycles and raises the temperature of 4 material 170 F. in 1 minute.

Standard automatic dual time controls permit the handling of two jobs pounds of average purpose plastic by the same unit, regardless of variations of the preform sizes or materials. The heater requires no manual tuning during the heating cycle. Controls are behind a locked door in the front panel.

Complete Trigger Control Provided with Gas-Gun

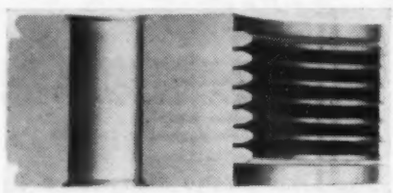
The Gas Gun, manufactured by Century Aircraft Co., 5601 W. Century Blvd., Inglewood, Calif., is a self-lighting, self-extinguishing acetylene torch. The gas ignites with pull of trigger and extinguishes on its release. Self-extinguishing feature eliminates fire hazards caused by torches left burning between operations. Balanced pistol grip makes gun easy to handle, reducing fatigue. Variations in flame, with temperature range of from 950 to 2000 F., are obtained by adjusting a pressure regulator. Device is suitable for soldering, silver-soldering, light brazing and lead burning, as well as aluminum soldering, sheet-metal work, low-temperature welding, tinning, paint removing, and general equipment-repair work.

Flame control by means of the pistol-type trigger eliminates accidental gas burns

Airfuge Static Separator Removes Contaminants from Air

Moisture, oil, and scale are removed from compressed air by the Airfuge separator manufactured by the Swartwout Co., 18511 Euclid Ave., Cleveland 12, Ohio. Air delivered by the unit is 99% free of contamination. Separator is made of high-tensile iron; interior parts are of corrosion-resisting materials. Bottom is removable for cleaning. Made in three sizes for different capacities and pipe connection sizes.

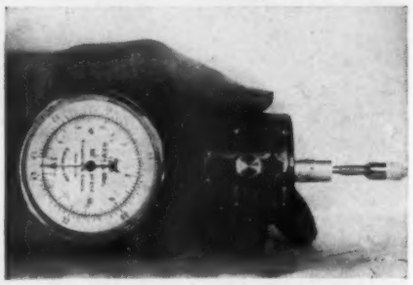
Locke Thread-ring Gages Have Clearance Below Roots



Full clearance at the thread root permits accurate gage settings and eliminates damage caused by dirt trapped at the root

Thread ring gages with clearance below the roots of the threads, making it possible to take full advantage of the adjustment provided without the set plug coming in contact with the root of the thread, are made by the Locke Gage Co., 10232 Woodward Ave., Detroit 2, Mich. Due to this clearance, it is possible to lap the entire side of each thread from crest to root, because the thread lap extends into the clearance space. This permits reconditioning of gages beyond their original life. The clearance space also serves as a receptacle for foreign particles which might become wedged between the thread surfaces.

Fingertip Speed Shift Ring Improves Scherr Tachometers

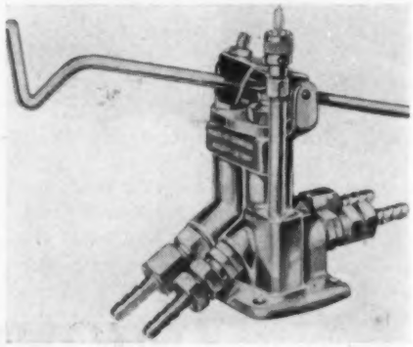


Fingertip control of the tachometer indicating range permits quick reading of sudden speed fluctuations

Precision hand tachometers, which operates on the centrifugal principle, are announced by George Scherr Co., 200 Lafayette St., New York 12, N. Y. Five speed ranges and a large knurled ring provide speedy shifting. Made in four models—Model A, from 30 to 12,000, B from 45 to 18,000, C from 60 to 24,000, and D from 120 to 48,000 rpm., each dial is individually calibrated for each instrument. Revolving shafts can be measured as close as 1 rpm. In the Model A, the hand reads to 1 rpm. and fractions of one revolution maybe estimated. Attachments also are provided to give feet per minute.

Model E Gasaver Valve Decreases Gas Consumption

Weldit Inc., 652 Bagley Ave., Detroit 26, Mich., manufactures this Model E. Gasaver, which cuts oxygen and acetylene consumption as much as 50% and has a non-smoking pilot light. Lever rod, on which torch is hung between welds to shut off both gas and oxygen intake lines, is adjustable in length, enabling torch of any size or weight to operate closing valves automatically.



Hanging a torch on the Gasaver hook closes the volume valves

An example of piercing standard size holes, special shapes and corner notching with Whistler adjustable dies.

Typical 3 section set-up of Whistler multi-use punch and die units.

Sectional drawing illustrating simplicity of assembly of punch and die unit parts.

PAT NO. 1939478

PIERCE 1/4" STEEL WITH WHISTLER MULTI-USE ADJUSTABLE DIES

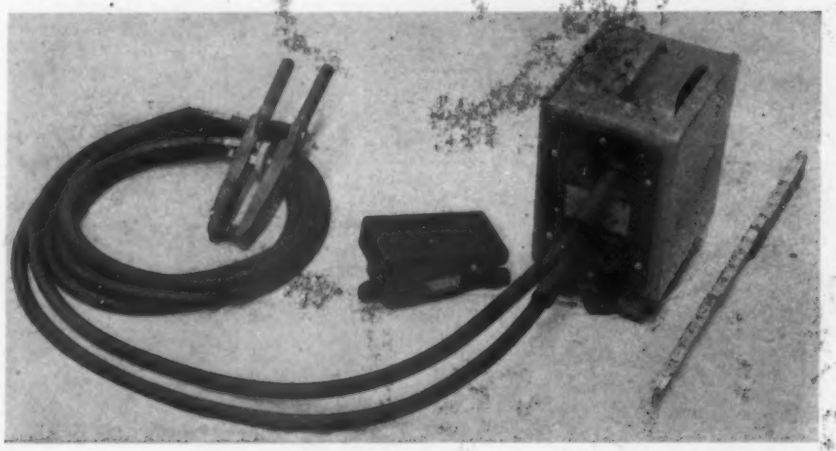
Here's another production time and money saving advantage from Whistler. Now you can use the SX series of heavy duty adjustable dies for piercing materials up to and including ¼" steel.

Punches and dies are available from stock in all standard sizes from ⅛" to 3" diameters. No time lost in getting into production. Absolute precision on short or long runs. Rearrange the same units... combine with notching, special shape or group dies if called for... and go right ahead on the next job. Whistler adjustable dies have unlimited use and pay for themselves over and over. Work in practically any type press and ordinary skilled workers can make set-up changes.

Whistler Adjustable Dies are being used by the top names in industry everywhere... there are reasons aplenty. Tell us about *your* piercing problems. Send blueprints. No obligation in finding out why Whistler Adjustable Dies should be working in *your* plant.

S. B. WHISTLER & SONS, INC.
752-756 MILITARY ROAD BUFFALO 17, NEW YORK

Westinghouse Brazing Sets Are Portable Units



A low-voltage transformer is used to supply high amperage current to the carbon-brazing tongs. Selective settings, for controls of brazing temperatures, are obtained with controls on the transformer case. A foot switch controls on-time

Self-contained portable brazing sets that require connection to a 220-volt power source for joining copper, brass, bronze, or various alloys by brazing, are manufactured by Westinghouse Electric Corp., Pittsburgh 30, Pa.

The sets consist of a transformer for providing high current at low voltage, voltage selectors, controls, and carbon-tipped tongs that can be clamped over the pieces to be joined. Three sizes available have capacities of 5, 10, and 20 kva., the two smallest units being air-cooled, while the large unit is fan-cooled and has a water-cooling system for cooling the cables and tongs. The smallest unit weighs 30, the intermediate 100, and the largest size 250 lb.

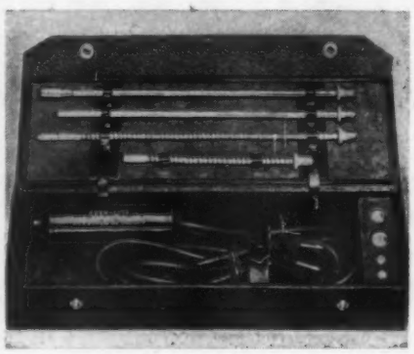
Tolerance of 0.0005 in. Possible With Eccentric Expanding Mandrel

A precision expanding mandrel with an eccentric sleeve, which will hold eccentric parts for grinding or machining within a tolerance of 0.0005 in., is announced by Erickson Tool Div., Erickson Steel Co., 2309 Hamilton Ave., Cleveland, Ohio. With this mandrel, eccentric parts can be turned or finished with the same tools and equipment as are used for concentric parts.

Interchangeable sleeves which fit one shank are available for different diameters. The sleeve collapses when the clamping nut is released. The collapsing sleeve will not injure highly finished internal surfaces. The expanding mandrel can be adapted for air or hydraulic operation, without altering the normal machine function, by providing for disconnects.

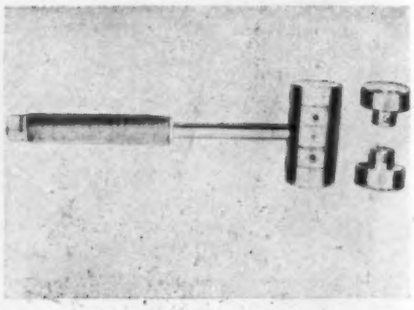
Tight Spots Lighted With Harmon Eder-Lite

A miniature inspection lamp, called Eder-Lite, is manufactured by Harmon & Co., 6 N. Michigan Ave., Chicago 2, Ill., to light up cylinders, gear housings, tubes, rifle barrels, pipes and other equipment with small



openings. Small light-reflecting and glareless metal-protected tungsten bulbs are attached to a flexible or rigid extension. Power is supplied through a rubber-insulated wire cable to a transformer enclosed in a bakelite handle. In fields where there is danger of explosion or fire, the lamp can be supplied in a special safety model. Standard set consists of a built-in pushbutton type transformer lamp handle, a 10-ft. plug-in cord and two rigid and two flexible extensions of different length that can be used in combination or separately.

Gregory Soft Hammers Have Interchangeable Heads



Two models of soft hammers are announced by Gregory Tool & Mfg. Co., 5300 Tireman, Detroit 4, Mich. One has a replaceable copper or brass head, the other replaceable brass or copper tips. Each type has 1¾-, 2-, 2¼-, or 2½-in. dia. heads and weighs from 4½ to 10½ lb. Equipped with safety leather-washer handle. Steel head on the removable-tip model is casehardened.

Cushman Power Chuck Wrench Operates Heavy Chucks

The electric power wrench manufactured by Cushman Chuck Co., Hartford, Conn., has been developed for use with multiple spindle chucking machines to eliminate the physical labor of manually closing and opening heavy chucks.

The motive power of a high torque, constant speed, stall-type reversible motor is applied through a train of gears and a splined sleeve to a sliding wrench shaft, controlled by the operator. The entire unit, including motor and switching controls, is so mounted on its bracket that the wrench shaft will automatically disengage should the machine index before it is withdrawn.

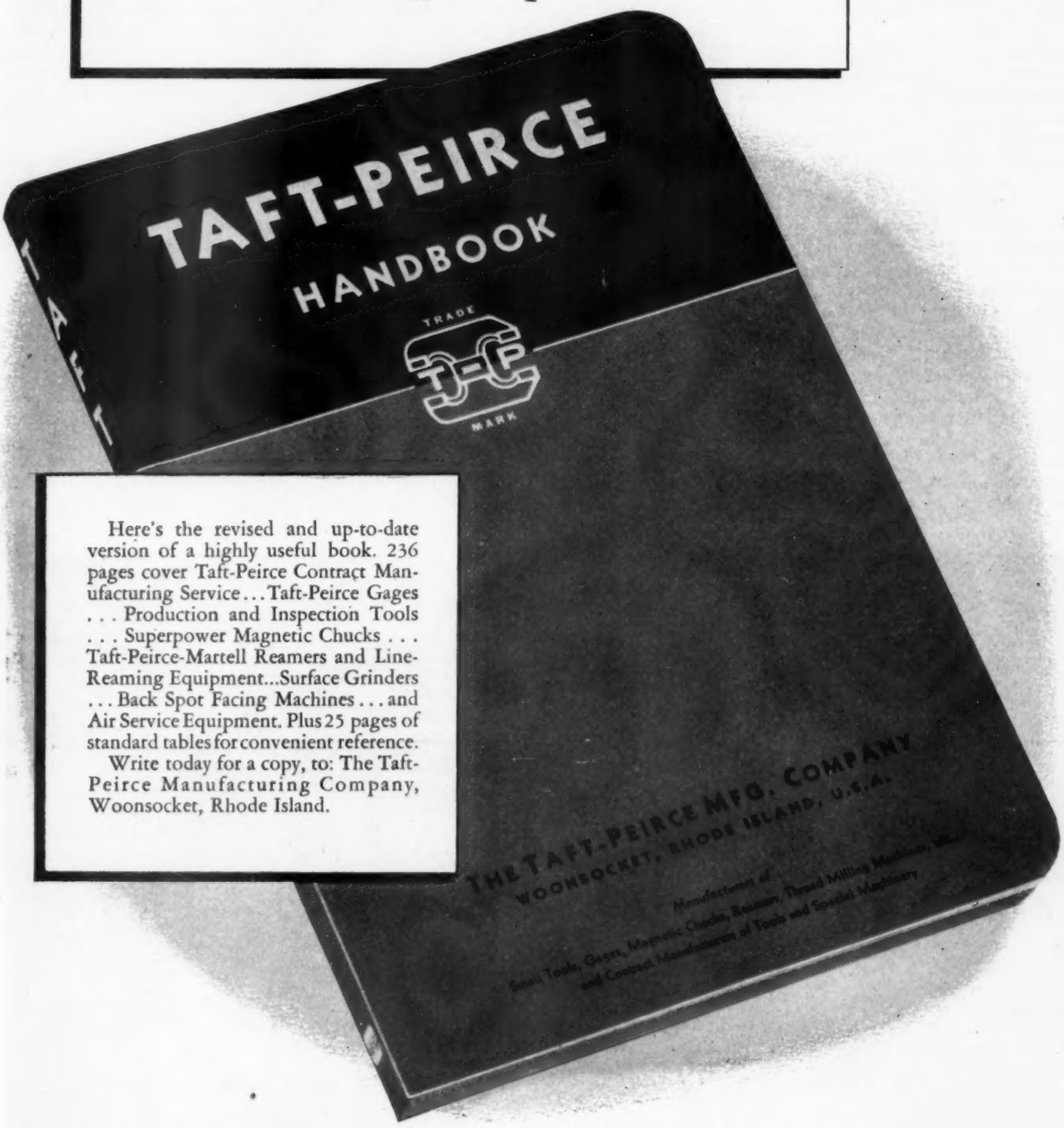
The power of the standard 840 wrench is developed by a motor with a torque of 24 ft/lb. which delivers a driving torque to a maximum of approximately 600 ft/lb. at the wrench end. If greater or less driving force is required, wrenches can be built to specifications on special order.

If variable control of torque is desired, the auxiliary equipment, consisting of a Cushmatic Control Cabinet, connected with either the lever drum switch or a push button station, permits reduction of torque to 50% of maximum.

You are Invited to Send for a Copy of
The 1946 Edition of

THE TAFT-PEIRCE HANDBOOK

just off the press



Here's the revised and up-to-date version of a highly useful book. 236 pages cover Taft-Peirce Contract Manufacturing Service... Taft-Peirce Gages ... Production and Inspection Tools ... Superpower Magnetic Chucks ... Taft-Peirce-Martell Reamers and Line-Reaming Equipment...Surface Grinders ... Back Spot Facing Machines ... and Air Service Equipment. Plus 25 pages of standard tables for convenient reference.

Write today for a copy, to: The Taft-Peirce Manufacturing Company, Woonsocket, Rhode Island.

Cincinnati Grinders Modernizes Line of Plain Precision Grinders

A line of four precision center-type plain grinding machines, 6", 10"-L, 10" and 14"-L, are announced by Cincinnati Grinders, Inc., Cincinnati 9, Ohio. The two sizes followed by letter L are light types, with all the characteristics and built in the same lengths as the sizes immediately preceding them, but having extra swing capacity to accommodate a flange or projecting arm on the work.

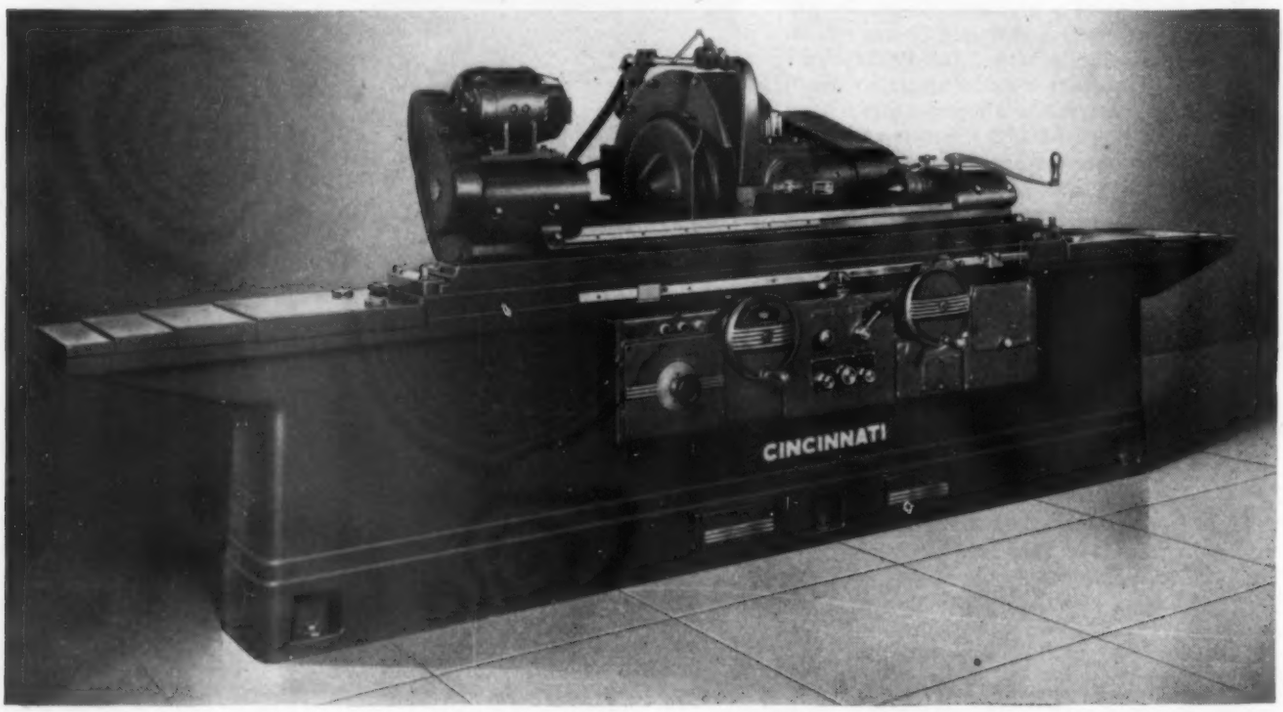
The same features are incorporated in all four sizes. Grinding-wheel spindles run on Filmatic bearings at each end of the spindle; and a bronze thrust bearing built around a shoulder mid-way between the ends of the spindle completes its mounting. These Filmatic bearings consist of five segments equally spaced around the super-finished spindle bearing diameter and are located by pins and adjusting screws so they can pivot. Filtered oil under light pressure is circulated to the bearing compartment. As the spindle rotates, it draws oil under the segments. They pivot a slight amount, creating a high pressure wedge-shaped oil film between each segment and the spindle. These self-renewing high-pressure oil wedges maintain exact dead-center rotation.

Tables are traversed hydraulically by means of an externally mounted motor-pump unit which obtains hydraulic oil from a reservoir in the machine bed. The cylinder, the inside diameter of which is machine-honed to eliminate tool marks and scratches, is attached to the under side of the table. One end is fixed while the other end is free to expand longitudinally. A piston and piston-rod arrangement allows for expansion of the rods also. There are two pistons, each connected to a lapped piston rod extending from the piston through the end of the cylinder. A small space between the two pistons allows the rods to expand longitudinally, thereby exerting no effect upon the accuracy of table traverse. Bleeder tubing, a choke coil to automatically dispose of entrapped air, and seal-ring packing to prevent leakage of oil, complete the hydraulic table-traverse equipment.

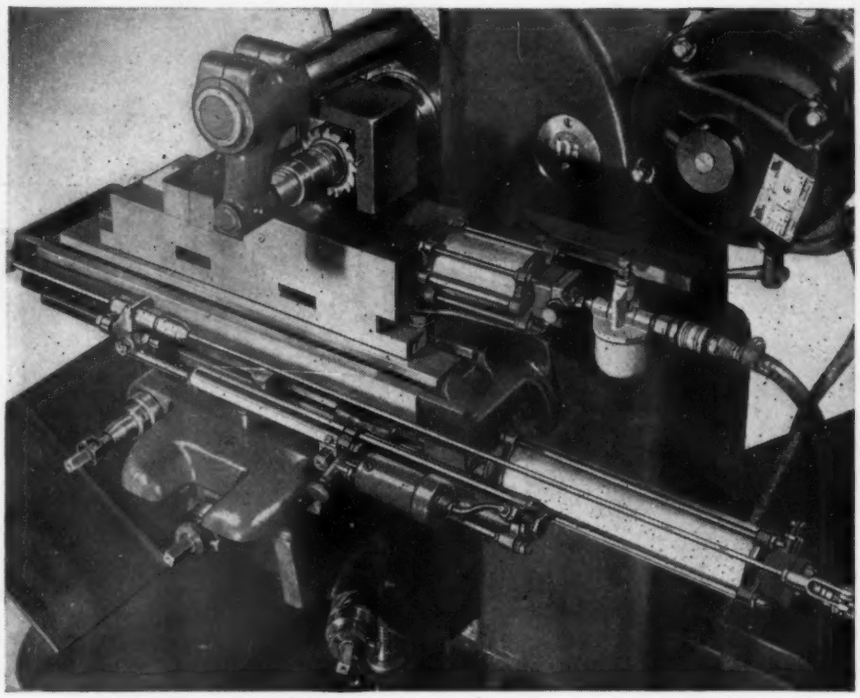
Table-traverse rates may be infinitely varied from 3 in. per min. (for truing), to more than 200 in. per min., through a knob control. A single lever control starts and stops the table traverse and coolant flow. If desired, the coolant may be hand controlled by means of a push-pull knob. Length of table traverse may be automatically dog controlled from the full rated stroke to as short as 3/32 in. Tarry at each end of the table stroke may be independently adjusted, from 0 to 5 sec., by means of knob controlled throttle valves. The handwheel at the left operates a servo-control which moves the table at the rate of 1 in. per revolution.

Infeed or cross traverse for the wheel head is controlled from the front of the machine bed by means of the large handwheel at the right. It features a large graduated dial which serves as a convenience in setting up the machine. Automatic pick feed at table reversal may be set for one to seven notches on the pick feed wheel; equivalent to 0.0004 to 0.0028 in. dia. reduction. Hand adjustment for sizing reduces the work diameter 0.0001 in. when the handwheel is moved one increment of spacing. The cross-traverse mechanism for 6 and 10-L machines is arranged for rapid hand traverse of the wheel head. It consists of a single tooth clutch operated by the lever which is partly hidden behind the handwheel. With this clutch engaged, one turn of the handwheel moves the wheel head 0.125 in., more than twice the speed of normal operation. Footstocks are combination handwheel and lever-retraction type. The center end of this spindle carries a truing bracket.

The design of the headstock unit depends upon the size of the machine. Headstocks for 6 and 10-L machines are powered by a ½-hp. ac. motor. Four spindle speeds are available, selected by means of a V-belt riding on 4-step pulleys. Speeds range from



More power to you
More speed to you
More profit to you



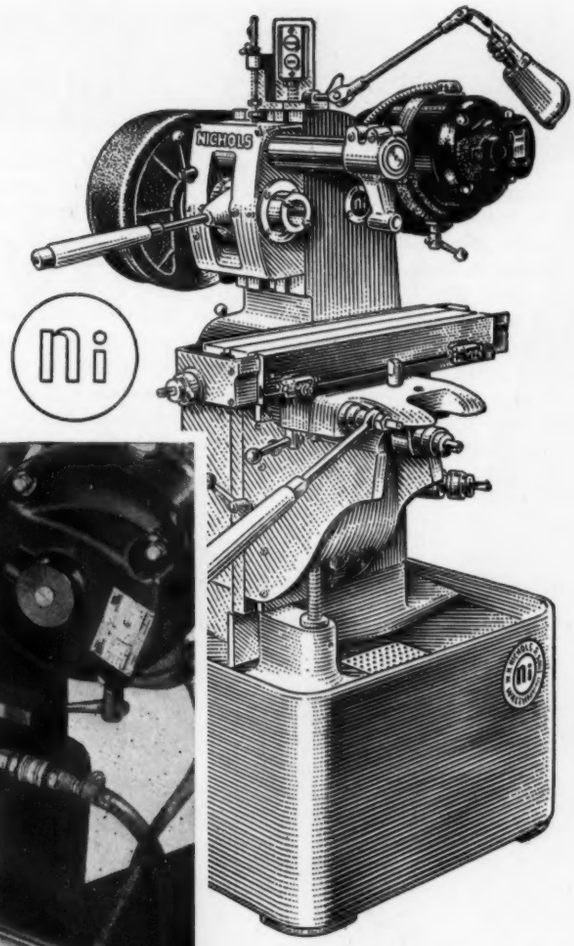


Photo shows Nichols power feed attachment installed. In this case, work is held in an air-operated vise

...with the *New Nichols* Power Feed Attachment

Here is a tested and proved power feed attachment that is an added production asset for *any* Nichols Miller. It is designed to reduce the time of the operating cycle and reduce the operator's duties so that often one operator can run two or more machines.

This power feed attachment is designed for fast table advance — maximum proper cutting feed — fast table return — automatic shut-off. It is completely automatic except for loading and unloading the work. Rapid traverse and work speeds are easily and quickly changed to suit all classes of jobs within the capacity of the machine.

Basically this attachment is a Bellows air feed unit used in conjunction with a Hydro-Check. Thus a positive, infinitely variable feed is obtained throughout the 9" maximum cutting stroke by using regular shop air lines with 75 to 175 lbs. pressure.

The Nichols power feed attachment can be installed either before or after shipment of the Nichols Miller. *It can be installed quickly on any Nichols Miller ever built.* Write for details.

Send for free Nichols Miller Catalog

THE *Nichols* MILLER

MANUFACTURED BY W. H. NICHOLS & SONS, WALTHAM, MASSACHUSETTS

NATIONAL DISTRIBUTORS: NICHOLS-MORRIS CORP., 40 CHURCH ST., NEW YORK 7, N. Y.

slightly less than 100 to nearly 400 rpm., depending upon the electrical characteristics. Headstocks for 10 and 14-L machines are powered by a 1-hp. dc. or variable-voltage ac. motor. Spindle speeds are changed by means of a built-in rheostat at the front of the machine. Speed ratios are approximately 4 to 1 for dc. equipment, and 12 to 1 for the variable-voltage equipment.

Power ratings for the larger sizes are 15-hp. wheel-spindle drive motor and 1½-hp. hydraulic motor. For the two smaller sizes: 7½-hp. wheel-spindle drive motor and 1-hp. hydraulic motor.

Air-O-Limit Adjustable Compensator Widens Measurement Range

To obtain higher magnification for the P&W Model B2 Air-O-Limit compensator, manufactured by Pratt & Whitney Div., Niles-Bement-Pond Co., West Hartford, Conn., an adjustable compensator has been announced which can be attached to the comparator. The adjustable compensator allows full scale graduations of 0.0004, 0.0006, 0.0008, and 0.001 in. to replace the full scales of 0.002, 0.003 and 0.004 in. that are normally used.

In addition to the use of higher magnification, the adjustable compensator offers greater diametrical clearance, better side compensation, longer wear life and greater speed at the higher magnification. A special series of gaging plugs is required as the gaging plugs regularly used with the comparator are not satisfactory for the adjustable compensator.

Brickseal Coatings Extend Life of Furnace Refractories

Products designed to increase the life of furnace refractories and give more uniform results in heat treating have been placed on the market by the Brickseal Refractory Co., 1029 Clinton St., Hoboken, N. J. Brickseal Special, a water-mix material of heavy cream consistency when properly mixed, is used to seal refractory walls against ingress of air or leakage of furnace atmosphere. The coating takes a partial air set at room temperature, a ceramic set at 1400° F. and vitrifies at 1900 to 2000° F. It will withstand operating temperatures of 2750° F. Brickseal is also available in other temperature grades, one of which glazes at the low temperature of 1450° F., while others are suitable for use up to 3200° F. Coatings are built up with brush or spray gun to 1/16 to ⅛ in. thick.

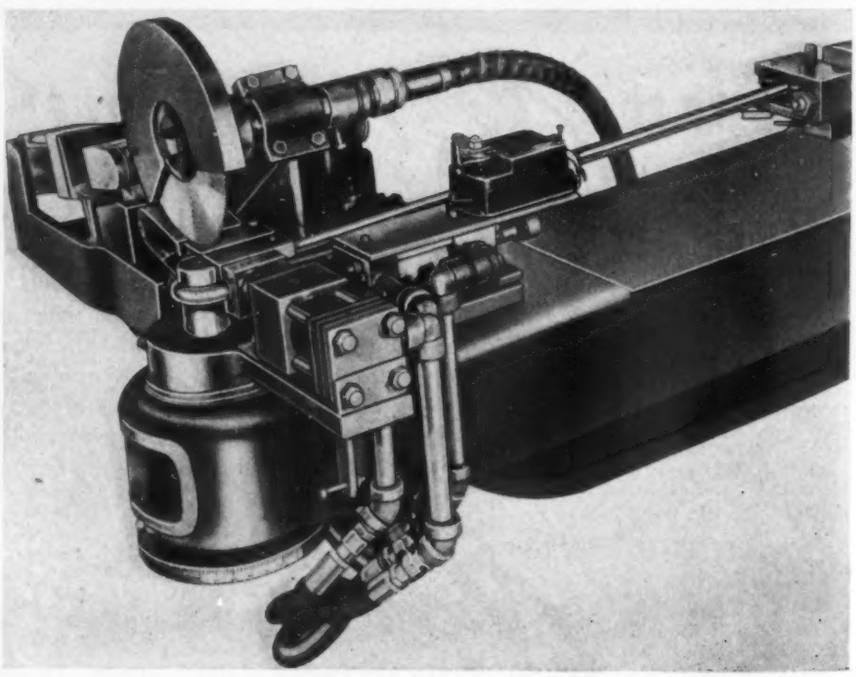
On cooling cycles the furnace cannot "breathe" air through the lining.

Another product, 36-X Super Duty Veneer, is offered for high-temperature heavy service in all types of furnaces. This material is applied in thin wash coats and is recommended for furnace floors and door jambs where abrasive wear constitutes a serious maintenance problem. Grooving of furnace floors by abrasion from heavy charges of metal is almost completely eliminated, with the result that such floors remain smooth throughout the life of the furnace.

Production of Bent Tubes Increased By Pines Cutoff Attachment

Pines Engineering Co., Aurora, Ill., announces an automatic cutoff for all 6 sizes of Pines automatic tube and pipe benders which handle tubing from ¾ to 5 in. O.D. and pipe up to 4 in. O.D.

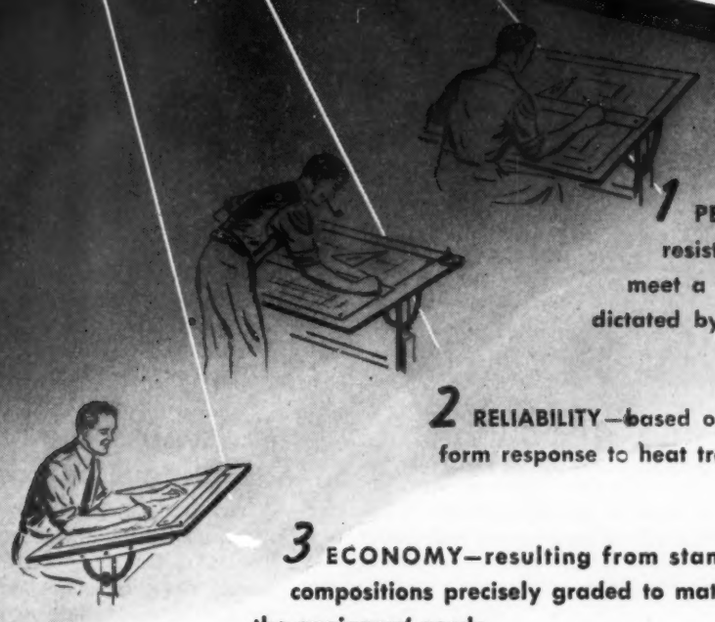
The machine uses the Pines booster attachment, for tube feed, and the automatic cutoff attachment. In operating the bender, a long piece of tubing is placed over the mandrel and the start button pressed. After the machine finishes the bend, the mandrel is extracted and, before the clamps are opened, the saw is passed through the tube by hydraulic power. The bending arm then returns and the mandrel advances. The tube is fed automatically and the operation repeats. The machine continues to operate automatically until the tube is used up.



Typical production of the Pines bender and cutoff combination is 650 pieces bent and cut per hour from ¾-in. tubing, bent on a 1¼-in. center

Triple reasons for specifying...

TRIPLE ALLOY STEELS *containing* NICKEL



1 **PERFORMANCE**—Strength and toughness, resistance to wear, fatigue or shock to meet a wide range of requirements, as dictated by design.

2 **RELIABILITY**—based on consistently uniform response to heat treatment.

3 **ECONOMY**—resulting from standard compositions precisely graded to match the engineers' needs.

Experience shows that triple-alloy steels containing Nickel are solving some mighty big problems in many industrial fields. They have established outstanding service records in some of the most exacting applications. The many standard compositions available make it possible to select *accurately*, and with economy, triple-alloy steels to fulfill the requirements of a great variety of applications.

We invite inquiries regarding the selection and uses of triple-alloy steels, containing Nickel.

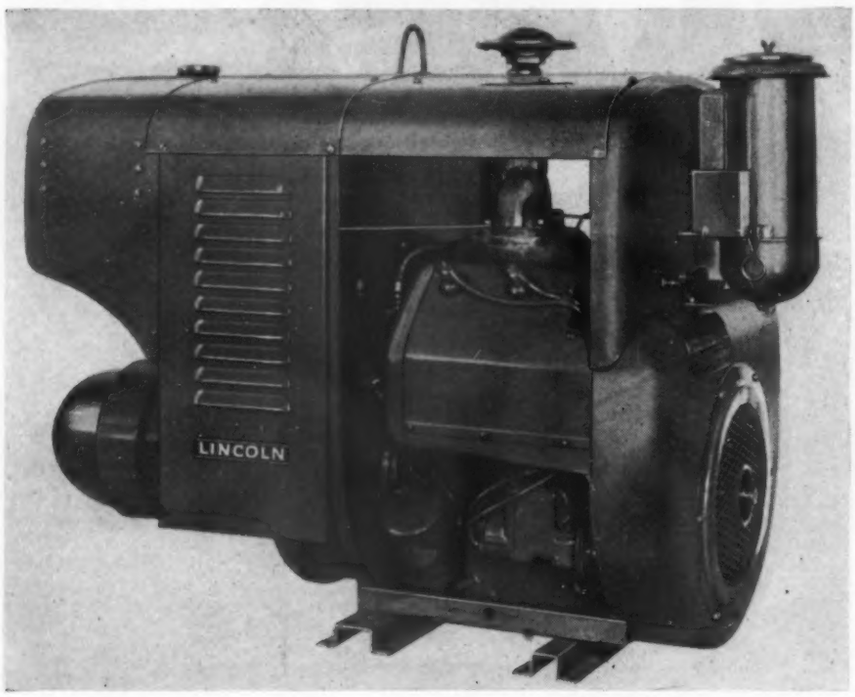
THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N.Y.

Current Range of 40 to 250 Amperes Generated by Lincoln Shield-Arc Jr.

A gasoline engine-driven portable welder is announced by the Lincoln Electric Co., Cleveland, Ohio. The Shield-Arc Jr. measures 24 x 48 x 30 in. and has a current range of 40 to 250 amp.

Provision is made on the output panel for three ranges of output current; continuous adjustment within these ranges being obtained by means of a simple speed control. Generator controls are mounted inside an enclosed cabinet above the generator, cooling being taken care of through a fan mounted on the generator shaft.

The welder is powered by a Wisconsin air-cooled 4-cylinder V-type engine. The speed of the engine determines the welding current by adjusting the engine speed between a maximum of 2100 rpm. (22 hp.) and 1500 rpm. (16 hp.). This type drive reduces weight and eliminates the necessity for winter care of the radiator. Equipped with a 6-gal. gasoline tank, the unit will operate, under normal welding conditions, for six hours before refueling.



Two transverse mounting rails for bolting to floor or platform permit the welder to be mounted on either shop trailer or road type two-wheel trailer

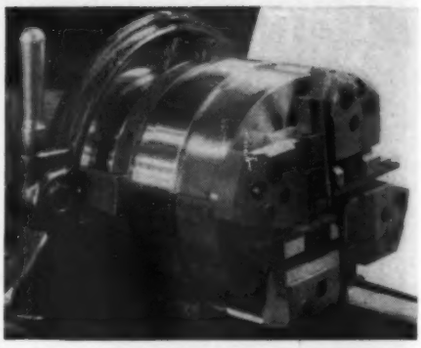
Interchangeable Chaser Holders Incorporated in Lanco VV Dieheads

The Landis Machine Co., Waynesboro, Pa., announces a series of Lanco VV hardened and ground die heads. They are in 1, 1½, 2 and 2½ in. sizes for use on hand-operated threading machines.

The chaser holders are clamped to chaser holder slides of heavy cross section. The manner in which the chaser holders are clamped to the holder slides permits the removal of the holders from the face of the head for interchange without disassembling any part of the head or removing the head from the spindle.

The chaser holder slides are gibbed to the head body. The inclosed design prevents the entry of chips or dirt. Zerk type fittings are provided to force heavy grease into the chaser slides and other operating parts to prevent the entry of fine cuttings which would cause wear. Fine adjustment for size is obtained by a graduated adjusting ring at the rear of the head.

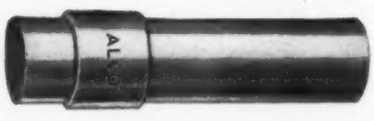
The type VV die head employs the Lauroc chaser and chaser holder, which is a rack tooth arrangement to locate the chaser in its approximate position after which an adjusting screw operating against the chaser clamp is employed to advance the chaser to the correct gage setting position. The chaser has rack teeth milled on the off-set seating surface of the chaser for its full length and these rack teeth engage a short section of mating teeth on the chaser clamps. The chaser clamp is held onto the chaser holder by means of a clamping screw which extends through an elongated slot in the clamp, the elongated slot being of sufficient length to permit a lateral movement of the clamp slightly greater than the pitch of the rack teeth on the chaser. This clamping arrangement permits adjusting the chaser to the proper gage position with no more than 3 or 2 turns of the adjusting screw.



The interchangeable chaser holders permit removal of the holders from the face of the head without disassembling any part of the head or removing the head from the spindle

Alco Revolving Stop Designed for Screw Machines

A revolving stop for automatic screw machines is manufactured by Alco Tool Co., Birdseye St., Bridgeport 4, Conn. Dual bearings are completely enclosed to exclude chips or dust. Revolving action of the head will not pick up grit, chips, or dust which cause roughing of the work. It is made in sizes from 3 to 6 in. over-all length, ⅝ to 1½ in. shank diameter, and 3/9 to 1½ in. contact diameter of head.



Revolving action of the Alco head does not pick up grit or grime which cause roughing of the work

DRAWN FOR JONES & LAUGHLIN STEEL CORPORATION BY ORISON MAC PHERSON

FOR EASILY MACHINED, ACCURATE PARTS USE— J&L COLD FINISHED STEEL

Your automobile is principally a product of steel—a family of steels made and finished in a variety of ways for the part each plays in giving you safe, fast, economical, dependable transportation.

Some parts are pressed. Others are forged. A great many stem from cold finished steel bars and shapes. Cold finishing of steel was discovered and developed at J&L. To this experience of the years has been added the quickening of research and production that the war demanded. Out of this now come new techniques and methods that promise profitable application in the peacetime manufacture of automobiles—of all manner of machines and equipment where strong, durable parts are needed.

The production of cold finished steel at J&L is integrated from raw materials to the hard, shining bars, the rounds, flats, hexagons and special shapes. Every step is controlled for quality. It is steel made to do the job, be it a gear in the water pump, the hard-working drive shaft or the special shapes that form the door hinges.

A few of the many uses of Cold Finished Steel in your car:

1. *Bumper guards—made from special shapes or ground bars.*
2. *Water-pump gear assembly.*
3. *Spark-plug parts.*
4. *Cold drawn tubing for rocker-arm shafts.*
5. *Piston pins.*
6. *Generator parts and shafts.*
7. *Control shafts on dashboard radios.*
8. *Speedometer gears.*
9. *J&L special precision ground stock for dashboard clock parts.*
10. *Steering column from cold drawn tubing.*
11. *Steering wheel hubs machined from cold drawn bars.*
12. *Door hinges from special shapes.*
13. *Door-lock and striker parts from special sections.*
14. *Nuts made from hexagon and special sections.*
15. *Grease and lubrication cups from cold drawn hexagons.*
16. *Transmission ring-gears made from special sections.*
17. *Running board treads molded in molds machined from cold rolled flats.*
18. *Drive shaft.*
19. *Seat adjuster rods.*
20. *Hydraulic brake connections and parts.*
21. *Shock-absorber parts.*
22. *Socket wrenches and jack (in tool kit).*

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH, PENNSYLVANIA

LIGHTER, STRONGER, CONTROLLED QUALITY STEELS

J&L STEEL

(Advertisement)

STEEL FOR MACHINES

Discouragement to autos was considered duty of many American municipalities when "horseless carriage" first appeared on streets, terrifying pedestrians. Ordinances put anti-speed humps in paving, forbade sale of gasoline, required drivers to send flagman ahead, compelled operators of steam propelled autos to become licensed engineers. Can you recall other similar restrictions?

1,500 makes of cars and trucks have been on market. How many do you remember?

Spark plugs in 1902 on Cadillac car were advertised as big feature because they could be taken off for cleaning "with the greatest of facility." Even then, as now, J&L cold finished steel was popular for spark plug shells.

Machines that make machines are called machine tools. They use cold finished steels in huge quantities to make other machinery and equipment and are themselves made of cold finished steel.

Organized in 1904, the SAE (Society of Automotive Engineers) brought about standardization of specifications that aided rapid development of motor cars.

Partial fabrication of parts is offered by special cold finished shapes in which J&L specializes, resulting not only in material and cost saving but in better physicals.

Before steel, machinery was laboriously, often clumsily, handmade of iron or even wood. The marvels of the present machine-tool age became possible when steel in abundance was made available in America about half a century ago.

Design engineers like new steels that are lighter, stronger, more workable and give them opportunities to re-design machines and equipment for greater usefulness at lower cost with less weight.

Gold medal for Jalcase Steel was awarded J&L at the Philadelphia Sesqui-Centennial Exposition. This grade was later adopted by SAE.

Bequests of iron nails, along with jewels, are found in wills of wealthy American Colonists because England forbade the Colonies to manufacture articles of iron.

Measuring to 5/10,000 of an inch with delicately balanced, jeweled gauges, so sensitive a watchmaker is employed to keep them accurate, has long been the practice at J&L in production of cold finished steel.

J&L Steel Data Chart, 29 x 45 inches, shows many tables (SAE, AISI, NE, and others) of tolerances, weights, hardness, machinability ratings, heat treatments, carburizing practice and spindle speeds for cold finished steel bars. For a copy write to Publicity Manager, Jones & Laughlin Steel Corporation, Pittsburgh, 30, Pa.

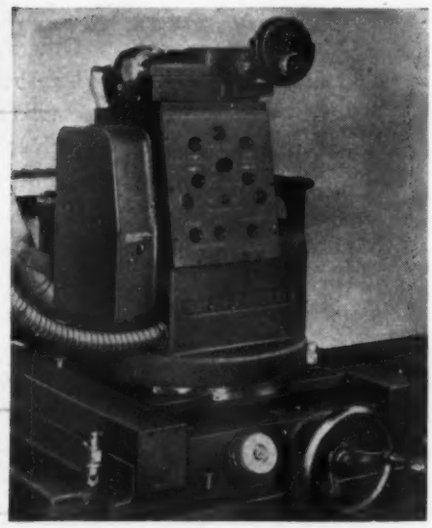
COPYRIGHT 1946, JONES & LAUGHLIN STEEL CORPORATION

Precision Optical System Guides Sheffield Electronic Templet Grinder

A templet grinder with electronic control of wheelhead axial traverse for the precise grinding of templets and other work up to 72 in. length, 8 in. depth, and 1 in. thick, without re-positioning, is announced by the Sheffield Corp., Dayton, Ohio. The templet grinder consists of a base, upon which a wheelhead with control panel and optical equipment traverses, the electronic control unit and a work table with adjustable parallel work supports. The work, with the desired profile marked by a scriber or a photographic process, or with a master templet mounted on top, is clamped on the work table. The supporting parallels are adjusted to the rough outline of the work. The wheelhead is positioned on the transverse ways by the electronic controls to bring the wheel opposite the point where grinding is to start. Axial movement of the workhead may also be accomplished by turning the knurled knob to the left of the handwheel. The wheelhead may be adjusted on a turret to a maximum of 40° each side of center to meet any requirement for positioning caused by shoulders or other irregularities of the profile to be ground.

The grinding-wheel reciprocating slide is then properly positioned for the required stroke within a range of 0 to 1¼ in. The speed of reciprocation may be set at either 50 or 100 strokes per min., as desired by the operator of the machine.

The wheel is brought in to the work by a manual cross-slide feed handwheel. Two ratios of cross feed are provided. The operator views the work through a 20 power microscope in setting the wheel to the work and in performing the grinding operation. He guides the microscope cross hairs along the lines of scribed work by means of the cross-slide handwheel as the wheelhead travels transversely. Four different reticles having diameters of 0.005, 0.0075, 0.010 and 0.015 in. are provided, with the microscope



All grinding controls are mounted below the eyepiece. The eyepiece remains in a fixed position while the objective lens follows the course of the grinding wheel

The templet table consists of spaced bars that are arranged laterally to give edge support to the work without interfering with the wheel

FREE INFORMATION FOR YOUR METALWORKING LIBRARY

New Catalogs, Booklets, Bulletins

METALWORKING EQUIPMENT

1 PLANERS—Rockford Machine Tool Co., Rockford, Ill. 14-page booklet No. 450 W-HSM on hydraulic openside planer explains table-drive and feed mechanisms. Operating features and construction illustrated and described.

2 MACHINING CHART—Rustless Iron & Steel Div., Baltimore, Md. File size chart gives actual data on cutting rates, tooling and relative machinability of stainless steels. Tools are shown with proper angles and forms for machining various grades of stainless steel.

3 COOLANT SEPARATORS — Barnes Drill Co., Rockford, Ill. 12-page Bulletin 151-D on automatic magnetic separator discusses construction, advantages and application on honing and grinding machines for removing metal swarf and abrasive particles.

4 SPECIAL MACHINES—W. F. & J. Barnes Co., Rockford, Ill. 48-page "Special Machine Tools for Diesel Engine Metal-Working Operations" tells how diesel engine manufacturers have used special tools to achieve low costs. Machines and operations illustrated and described for producing crankcases, cylinder blocks and heads, connecting rods, pistons, liners and jackets.

5 SHAPERS—Smith & Mills Co., Cincinnati, Ohio. 24-page Catalog 45 on 12 to 32 in. heavy duty crank shapers describes construction, control features and accessories. Separate section contains operating and maintenance instructions.

6 SWAGING MACHINES — Standard Machinery Co., Providence, R. I. 20-page Catalog SM includes complete details on regular swagers for pointing and sizing and on cable and hydro-former swagers for metal shaping and attachment of fittings to bar, cable and tube.

7 TREAD GRINDERS — American Car & Foundry Co., New York, N. Y. 12-page "A.C.F. High Speed Wheel Tread Grinder Operating Manual" contains step-by-step instructions for operating grinder and describes all adjustments, wheel dressing and face plate indexing.

7A CENTERLESS GRINDERS—Triplex Machine Tool Corp., New York, N. Y. 26-page catalog 1507E on Lidkoping centerless grinding machines illustrates operating principle, machine details, standard accessories and special attchments.

TOOLS AND ACCESSORIES

8 GROOVING TOOL—Lyon Machine Co., Worcester, Mass. 4-page folder "Internal Grooving Tool" illustrates tool for recessing, grooving, undercutting and necking. Describes operating features, tolerances obtainable, range of sizes and typical jobs.

9 CENTER DRILLS — Howard H. Heinz, Inc., Detroit, Mich. 6-page folder on Hy-Co center drills explains effect of spherical contour of tip on life of drill, easy removal if broken, burnishing of machined seat, elimination of center grinding and prevention of chip jamming.

10 JIG CLAMPS — Universal Engineering Co., Frankenmuth, Mich. 8-page folder "Grippits and Index Plungers" contains data on their operating features and shows adjustments and suggestions for use as quick-acting jig clamps.

11 HIGH SPEED DRILLS—Republic Drill & Tool Co., Chicago, Ill. 8-page Bulletin J-1 announces "Jet Drill" for high speed drilling. Describes action of rotary bushing in forcing coolant down intermediate flutes and effect on drilling speeds and chip removal.

12 FLY CUTTER — New-Field Machined Parts Co., Chicago, Ill. 4-page folder CB-246 illustrates and describes universal fly cutter having four removable tool bit cutters. Uses shown in slotting, radius cutting, form and straddle milling and surfacing operations.

13 BORING BAR—Behr Products Co., Warren, Mich. 4-page Catalog 101A describes boring bar used for boring, spotfacing, fly cutting, recessing and other operations. Illustrates adapter that adds to range of diameters, from ¼ to 12½ in., and gives specification charts that indicate proper blades.

14 TAPS — Electrolized Tap Corp., Providence, R. I. 4-page Bulletin "Electrolized Taps" describes the line of taps that are cased with hard alloy deposited by electrolytic bath. Specifications and prices included for standard and spiral hand and machine taps.

15 CHUCKS — Jacobs Manufacturing Co., Hartford, Conn. 4-page Bulletin 45-P describes application of rubber-flex chucks to heavy duty drilling and reaming on multiple-spindle machines. Specifications, construction details and fitting methods given.

16 CUTTING TOOLS—Delloy Metal Corp., Philadelphia, Pa. Fully illustrated catalog lists standard lines of tools and gives physical and mechanical properties, cutting speed chart and data on form tools and precision castings.

17 MARKING DEVICES—Pittsburgh Stencil & Tool Co., Pittsburgh, Pa. 12-page Bulletin "Rick Marking Devices and Cutting Tools" describes and illustrates various types, including solid, hammer and holder insert stamps, roll block tools and branding wheels for chilled rolls and rolled shapes.

How to Order

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HEAT-TREATING AND WELDING

18 INDUCTION HEATING—Eastern Heat Treating & Brazing Corp., New York, N. Y. 20-page booklet "Condensed Guide to Heat Treating" contains general discussion of heat treating and brazing by induction heating, section on alloys in steels and SAE nomenclature, hardness tables and data on ductility, conductivity and weights.

19 GAS CUTTING—Victor Equipment Co., San Francisco, Calif. 4-page folder No. 69 announces pack type emergency flame cutting outfit. Portability and compactness illustrated to show use in accidents, fires, wrecks and other emergencies.

20 ELECTRODES—Hobart Bros. Co., Troy, Ohio. 18-page strip folder DM-710 lists complete line of arc welding electrodes. Furnishes description, application, procedure, physical properties of deposited metal and sizes of each electrode.

21 HARD-FACING ALLOYS — Wall Colmonoy Corp., Detroit, Mich. 8-page Catalog 76 contains data on physical properties of Colmonoy hard facings, application and electrode sizes. Separate section discusses applying by furnace weld, oxy-acetylene, electric arc and spray weld. Illustrates lathe center and centerless grinder blade tips.

PLANT SERVICE EQUIPMENT

22 PULLERS—William S. Pine, Los Angeles, Calif. 24-page booklet "Jenny Hydraulic Pullers" describes and illustrates models from 30 to 100 tons. Application for various shop jobs shown by number of page-size photos including liners, axles, valve seats and condenser pipes.

23 HOSE AND COUPLINGS — Packless Metal Products Corp., New Rochelle, N. Y. 72-page Catalog E-1 lists complete line of flexible hoses and couplings and describes construction, applications and installation. Illustrates self-flaring copper and plastic tubing couplers. Contains data on pipe threads.

24 INFRA-RED HEATING — Fostoria Pressed Steel Corp., Fostoria, Ill. 12-page brochure "Infrared Parade" shows wide variety of Evenray infra-red installations for paint baking and explains infra-red radiation and efficient utilization. Describes other uses in drying, preheating and dehydrating.

25 FORK TRUCKS — Baker-Raulang Co., Cleveland, Ohio. 8-page Bulletin 1311-F describes and illustrates 2- and 3-ton single and telescoping fork trucks. Complete details given on controls, drives, mechanical features, turning radii and aisle clearances.

26 SPRAY NOZZLES—Yarnall-Waring Co., Philadelphia, Pa. 16-page Bulletin N-616 on spray nozzles for water cooling, air conditioning and general industrial uses. Nozzles and spray characteristics described engineering data and capacity charts given for different types, and typical installations and construction suggestions illustrated.

27 PORTABLE CONVEYOR — Rapids-Standard Co., Inc., Grand Rapids, Mich. 4-page folder PV-N-46 announces improved "Press-Veyor," a portable belt conveyor for press-room and general conveying. Describes operation, limits of use, motor data and general specifications.

28 FLOOR MACHINES—G. H. Tennant Co., Minneapolis, Minn. 2-page bulletin describes electric, self-propelling industrial floor machine, model J, and its applications including removal of incrusted grime, dry cleaning, sweeping, polishing, burnishing and sanding of floors.

29 LIFT TRUCKS—Hyster Co., Portland, Ore. 16-page booklet 1016 on Hyster lift truck model 40 explains advantages of pneumatic tires, describes details of truck and use of pallets and skips and gives specifications on turning radii.

PARTS AND MATERIALS

30 METAL AND ALLOYS—Westinghouse Electric Corp., East Pittsburgh, Pa. 48-page book on special-purpose metals and alloys covers magnetic metal; electrode, filament and contact metals; sealing metals; joining materials; and heat-resistant alloys. Gives complete engineering data on physical characteristics and applications. Comprehensive table covers properties of metals and alloys offered.

31 STAINLESS STEEL—Eastern Stainless Steel Corp., Baltimore, Md. 96-page book contains technical data useful to all users of stainless steel, descriptions of various types of steel, illustrations of different finishes, an extensive section on processing and fabrication, and reference tables.

32 ROTARY PUMPS—Blackmer Pump Co., Grand Rapids, Mich. 8-page Bulletin 307 discusses swinging-vane principle of rotary-pump construction, valve design, use of steam-jacketed heads and advantages of removable liners. Operating cycle illustrated to show action of swinging buckets.

33 PLASTIC FILMS—Better Finishes and Coatings, Inc., Newark, N. J. 12-page folder on "Present and Potential Applications of Liquid Envelope in the Metal-Working Industries" describes applications of modified vinyl polymers for surface protection during forming of metals, safeguarding of tools and protection of parts in transit.

34 HYDRAULIC CYLINDERS — Logansport Machine Co., Inc., Logansport, Ind. 32-page Catalog 84 announces "Rotocast" hydraulic cylinders, describes engineering developments and features and gives complete specifications and data on various cylinders.

35 TORQUE CONTROL COUPLINGS—Buffalo Machinery Co., Inc., Buffalo, N. Y. 8-page Bulletin 1007 describes machine tool and transmission types of torque control couplings. Illustrates application in drilling, reaming, tapping, stud driving and nut setting. Ft-lb. settings given for different operations and metals.

36 HYDRAULIC PUMPS — Superdraulic Corp., Dearborn, Mich. 8-page strip folder "Superdraulic Pumps" describes construction, operation and application in hydraulic machinery. Performance curves, combination table, circuit diagrams and installation drawings given.

37 CUTTING FLUIDS—D. A. Stuart Oil Co., Ltd., Chicago, Ill. 20-page booklet "Water-Mixed Cutting Fluids" contains valuable information on soluble oils, performance, handling, hygiene, suggestions for mixing and applying, and design data for coolant systems.

38 STEEL BARS—Monarch Steel Co., Indianapolis, Ind. 24-page Catalog "Speed Case and Speed Treat Cold Finished Steel Bars" contains data on their machinability, carburizing, ductility and physical properties. Cutting feeds and speeds recommended. Application studies and hardenability charts shown.

39 DROP FORGINGS—Drop Forging Association, Cleveland, Ohio. Booklet "Metal Quality-Hot Working Improves Properties of Metal" and "Drop Forging Topics" issued every 60 days contain wealth of valuable information for producers and users of forgings. Latest forging developments and applications explained and illustrated.

40 STEEL CASTINGS—Steel Founders' Society, Cleveland, Ohio. Series of bulletins covering results of extensive research program carried on by Society in cooperation with leading universities and industrial laboratories. Subjects covered will include metallurgical properties, specifications and heat-treatment of cast-steels and useful engineering information on castings.

41 MOLDED RUBBER PARTS—Aero-Seal Rubber Products, Chicago, Ill. 32-page booklet "Mechanical Molded Parts from Synthetic Rubber" discusses various types of synthetic rubbers, compounding, extruding and molding. Different molds and wide variety of rubber parts illustrated.

42 STAINLESS STEELS—Allegheny Ludlum Steel Corp., Brackenridge, Pa. Four reference "Blue Sheets" announced on stainless steel castings, stainless types 347 (18-8C) and 321 (18-8T), type 416 free machining chromium, and Ludlum 609 shock resisting. Cover properties, corrosion and oxidation resistance, effects of elevated temperatures and heat-treating procedures.

43 PAINTS—Peninsular Chemical Products Co., Van Dyke, Mich. 4-page Bulletin 10M-H-1-46 on Pen-Kote 500 chemical-resistant maintenance paint shows application to all kinds of surfaces. Test strips demonstrate protection provided by paint against hot acids, alkalis and water.

44 LUBRICATING OILS—Protective Coatings, Detroit, Mich. 6-page folder "Micronoil Electronized Lubricants" discusses lubricating, inhibiting and cutting oils. Recommends mixtures for particular jobs and conditions.

45 PUMPS—Ruthman Machinery Co., Cincinnati, Ohio. 16-page condensed catalog describes entire line of vertical, motor-driven Gusher coolant pumps for machine tools. Mechanical and operating characteristics, installation and maintenance covered for various models.

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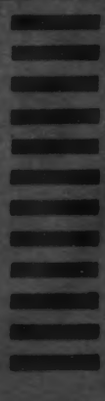


"Measuring at the Machine"

MINIMIZES PRODUCTION LOSSES!

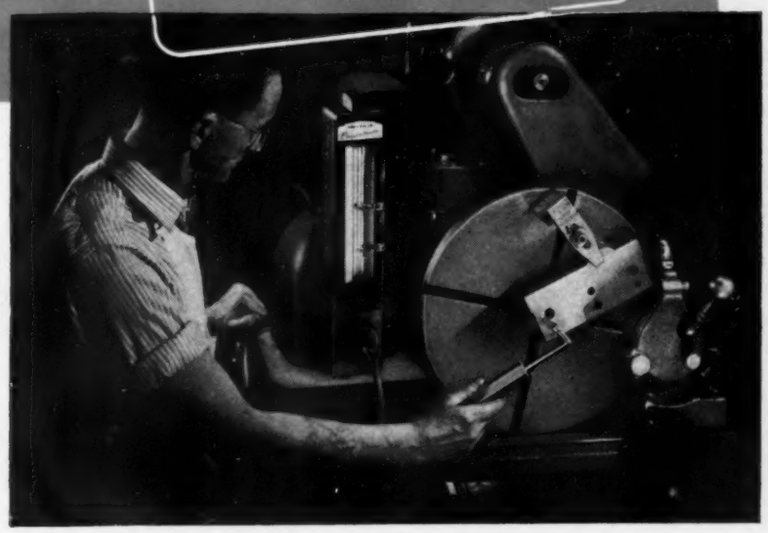
Reducing production LOSSES means reducing production COSTS. LOSSES usually occur at the machine—stopping such losses brings down costs.

"Measuring at the Machine" brings the following advantages which contribute to being able to sell a product profitably at or under competitive prices:

1. When accurate gaging is practiced right at the production machine, scrap losses have been reduced as much as 80% and 90%.
2. "Measuring at the machine" practically eliminates salvage work which is nearly always costly.
3. Component parts reaching the assembly line fit quickly and easily—no assembly time lost. Instead of working to the high limit as an operator normally does, he works to hit the part "on the nose."
4. When high production gaging instruments like the Multichek, Precisionaire and Visual Gage are used at the machine, the floor space devoted to inspection operations, gage maintenance costs and the labor cost of inspection are all greatly reduced.
5. Under close dimensional control, finished products give maximum performance, greater service life, and help build prestige for the manufacturer.
6. Fewer parts will wear out in service, and then replacement is quickly and easily done —no laborious fitting in the field will be necessary.

chek with Sheffield on "Measuring at the Machine"

1767



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Dayton 1, Ohio, U. S. A.

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CONTRACT SERVICES

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Vast throngs of new shop workers, trained in war industries, used "Yankee" Fine Mechanics' Tools for the first time . . . mastering fresh trade skills which now stand them in good stead for the vital production period ahead. They have learned what skilled mechanics and old-time factory men long knew . . . that "Yankee" Tools complete innumerable tasks *faster, easier,* and *better.* For half a century, the ingenuity of "Yankee" Tools has set a high record in speed and accuracy.

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North Bros. Mfg. Co., Phila. 33, U. S. A.
Established 1880

ROUND TABLE DISCUSSION

GOOD EQUIPMENT PAYS OFF

In considering your Round Table question of "Profit Taker or Profit Maker?" I cannot visualize anyone buying new equipment for his shop purely for the purpose of disposing of his profits.

Through the years I have observed the growth of many tool shops which have had their start in basements or garages. Shops that progressed were the ones that systematically replaced old machinery with newer equipment. This was done for two reasons: first, better equipment had to be purchased to meet surrounding competition, and second, in most instances the newer equipment produced a better job in a shorter time, thereby increasing profit margins.

A tool shop can make jigs and dies by still pursuing the old method of laying out holes with the button method, but it is the shop which is equipped with the jig borer that will get the greatest amount of business, and at the same time be in a position to buy an improved model machine or add another machine to its equipment setup. Furthermore, the well-equipped shop contributes to better working conditions and will attract men of high calibre. These latter two factors are certainly worthy of consideration.

Peter L. Budwitz
Meriden, Conn.

•

HOW ABOUT SCHEDULED MAINTENANCE?

I read about this topic with interest. Maintenance, in my opinion, should be performed by a special crew wherever possible. In small shops, operators can maintain their own equipment, making minor repairs where necessary.

Scheduled repair and checkup is excellent procedure when the shop is large enough to warrant its operation. Coddling does not make tools last longer. In fact, ironing out small defects before the job starts saves a lot of fuss and worry over whether tools will hold out until the job is finished.

When I assumed my present post eight years ago, we had some English lathes of the old belt-driven type. Neglect had placed them in disgraceful condition. I had one of them repaired and today it is working as well as many modern lathes. I have since endeavored to have at least two repaired each year and they have assisted materially in helping us to meet the pressure of war production years.

D. M. Durant
Rancagua, Chile

•

HOW ABOUT ANNUAL WAGE?

Although there is a natural desire to remove some of the anomalies that exist between the black-coated worker and his brother at the bench or machine in metalworking plants in this country by continual agitation for holidays with pay for all industrial workers, I do not believe that Al's suggestion to pay an annual wage to keep good men in metalworking plants is practical. True, happiness of industrial workers is closely bound up with their financial prospects, but this is probably due to the fact promotion normally carries with it increased remuneration rather than the monetary increase, or an annual wage.

I consider the best stimulus toward increased efficiency in metalworking plants, also to keep good men happy, is the method of payment by results. In fact, it is only by introducing schemes whereby good men can rely on being paid by results, without fear of any cutting of prices, that the engineering industry can hope to compete in the markets of the world.

Unquestionably, an annual wage to workers in metalworking plants is impractical, as commodity prices would tend to increase by an amount which is economically unsound and in the worst interests of his country.

A. Eyles
England

•

FOREMAN'S FUNCTIONS

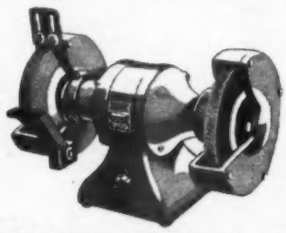
As everything else in this world, so the titles and designations of the various jobs and positions in industry have undergone quite a change in recent years. The man most affected by these changes is the old-style foreman.

At one time it was the foreman who was *the man* in any industrial establishment. Everybody looked to him for guidance, even in matters not exactly pertaining to the job at hand. He was absolute in his own right, he fired, he hired, he scolded, he praised. He awarded raises as he saw fit without the assistance of a personnel office, a safety director, and other men whose duties now complement the foreman's.

They Do More.. Better... Faster

"WHIRLWIND"* WIRE BRUSHES CUT COSTS, STAND UP LONGER ON HIGH SPEED WORK

For Portable Grinders: Whirlwind Brushes come in 4" to 8" wheel sizes; made of .014" wire for rough cleaning, .0118" wire for high-speed buffing, .005" wire for fine finishing and burnishing.



For Stationary Grinders: Whirlwind Brushes come in three thicknesses, in six wheel sizes from 4" to 12". Can be used on many types of machines. Adaptors fit them to 'most any arbor or spindle.

For Portable Sanders: Whirlwind Wire Cup Brushes make quick work of removing rust, scale, old paint; cleaning castings, structural metal, tanks, boat hulls, other surfaces. Made in 4", 5" and 6" sizes.

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DEVELOPED and made by Black & Decker for high speed work, Whirlwind Wire Wheel Brushes are definitely better, tougher, work faster and last longer. That's because crimped wire gives Whirlwind Brushes extra life and spring . . . assures correct clearance between wires . . . holds the brush in an even, compact mass. And each individual tuft of wire is held in a ring of steel . . . separately . . . securely . . . to stay.

Whirlwind Brushes are available in wheel sizes from 4" to 12" in three thicknesses, and in three gages of wire . . . for use on almost any grinding, buffing or polishing machine and on all Black & Decker Portable Grinders, Bench Grinders and Sanders. Try Whirlwind Brushes now. Order them from your Black & Decker Distributor. Compare the service and satisfaction Whirlwinds give you with brushes of any other make.

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Many managers of the old school resent this change and it's understandable; many are cooperating willingly with the new setup, usually with benefit to all concerned. The advisability of these changes will not be argued here. I would only like to leave this thought with both executives and foremen: Do not lose sight of the basic necessity and reason for the existence of a foreman in an industrial plant, namely his function as coordinator of men and ideas.

Nothing can ever completely replace the function of the human mind. The better the individual mind, the better the aggregate of the collective effort of the whole organization. All human beings differ one from another, but almost everyone has some talent, some knack for doing a certain job better than the next fellow. To ferret out these qualities in any employee and then place the man in the position and on the job he is best suited for, should be the job of the foreman, notwithstanding all job rating systems and methods.

Another vital function a foreman has to perform is keeping the contact between management and labor. There is always a feeling of immense satisfaction for any employee when he can talk to the man with authority. All the qualifications of a good foreman can perhaps be best summed up in the following statement: A foreman must possess in abundance the greatest of all human faculties, that of good judgment.

Perhaps it was the lack of this quality that forced industry to adopt systems and methods that seemingly abrogate the power of the man who used to be master in his sphere of action, but after all, we had barely emerged from a great depression that saw little training of new men for positions of management. When war struck, industry had to install as supervisors men who often lacked some of the qualities of a good foreman. Perhaps the various agencies created by industry to complement the foreman were born of necessity.

In my opinion, the foreman of yesterday can come back to his original position as monarch of the establishment if he recognizes the need for the qualifications he must possess and trains himself accordingly.

Fred Jeddeloh
Waseca, Minn.

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Production Costs

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Precision Blade manufacturing is the secret of hack sawing efficiency. Accuracy in milling and in setting the teeth must be constantly maintained by a well organized inspection system. At Capewell inspection has been developed to a position of leadership through 65 years of pre-eminence in the metal-working industry. Let your distributors show you how Capewell power hack saw blades cut costs on your own tough jobs. We depend on distributors to give you service. Telephone your distributor today.

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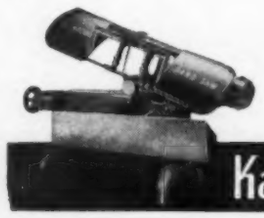

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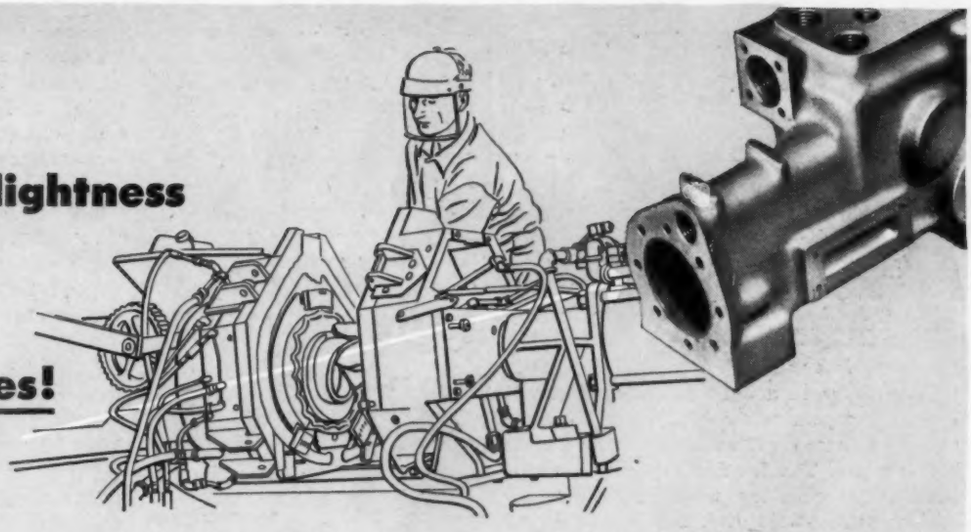

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—with magnesium and the permanent mold method

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In many jobs, where production quantities are large enough, important savings in weight and machining can be yours through the close control possible in the casting of magnesium in permanent molds. And this material-and-method team gives you full benefit of magnesium's combined lightness, soundness and strength.

The Dow magnesium line includes alloys especially engineered for permanent mold casting. Applications now in use include a wide variety of fittings, brackets, housings, and other parts. For detailed information and engineering assistance in magnesium application, simply make your needs known at the nearest Dow office.

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Available Dow magnesium forms include alloys for permanent mold casting with good casting characteristics and mechanical properties.

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To hold 1600° F. in the MH-3 furnace requires less than 2 kw. At power rate of 2c per kw.-hr., operating cost is under 4c per hour. The MH-4 furnace requires less than 2.5 kw. or under 5c per hour at the same rate. Cooley Furnaces are easily installed—ready for immediate service by connecting power lines to two terminals. Quiet in operation—no fumes or odors—no ventilating necessary—they can be located at any convenient place in the shop.

MORE PROFITABLE REASONS FOR USING COOLEY FURNACES

1—Hardening, drawing and tempering small batches in large furnaces is uneconomical.

2—Small parts can be normalzied and annealed quickly and easily.

3—Convenient for pre-heating prior to high-speed hardening.

4—Always available to handle emergency repair work without delay.

5—Use as a pilot furnace to predetermine techniques for production heat treating.

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1. Vertical Lift Door—Counterweighted for ease of operation—conserves heat where door need not be fully opened to enter or remove work. Supplied in place of standard hinged hearth door at $20.00 additional to regular furnace prices shown below.

2. Heavy Gauge Steel Stand—For ease of installation and operation—locates furnace at most convenient operating height and provides additional working and storage space. Add $35.00 to regular furnace prices shown below.

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AUTOMATIC CONTROL—Indicating Controlling Pyrometer—Thermo-couple and lead wire complete—price depends on selection—approximately $150.00.

NO SALESMEN WILL CALL

Ask for free information and ordering instructions so you can make your own decision and determine your own requirements. Write for Bulletin No. 50 today—no obligation.

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MOUTHPIECE OR MANAGER?

There are several "wrongs" in your "Round Table" subject of Mouthpiece or Manager. The wrongs should be charged against the following characters.

First, "Big Boss" should not permit any of his employees, especially a relative, to ask him for a favor that can easily be granted by the department foreman. If "Big Boss" continues these practices his organization is headed for more serious trouble.

"Ed," the foreman, must brush up on his apparent knowledge of how to be a good foreman. His tactics must be fair and his men must know it. This would have dispelled "Tom's" fear of asking and he would not have gone to "Big Boss."

Calling in the Personnel Department as "Al" suggested is fine if he wants a foreman to learn quickly how to shirk responsibilities. Also the Personnel Department entering into a personal problem of a foreman and an employee would succeed quickly in destroying prestige that should be reserved for the more complex problems concerning the entire shop group or departmental issues.

Now "Ed's" desire to be a real manager is fine. However, real managers today know how to use the specialist groups to the advantage of the company and themselves without losing their managerial ability.

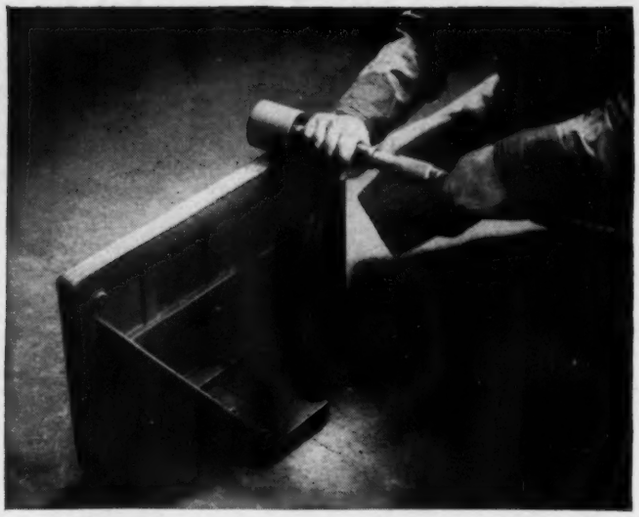
With the complicated price structure on today's products, special machinery requirements and new methods applications for production, "Ed's" desire to do the bidding from the front office would not improve the company's chance of receiving or processing an order.

Lester Heff
York, Pa.

•

MOUTHPIECE OR MANAGER?

Every growing factory must, at one time or another, change from a compact little unit into a plant that must incorporate all the governing departments, such as Production Control, Inventory Control, Personnel and so forth, in order to operate economically and efficiently. It is in this phase of growth that the article "Mouthpiece or Manager" must have been written. I can readily see both sides of the issue. It is definitely to the foreman's advantage to have the assistance of the various departments so he can spend more time in the direct supervision and thoughts of his men; but it is very difficult for him to relinquish his authority, especially if he has had almost complete charge of the shop prior to the



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The Flexible Shaft Machine occupies a unique place in Industry. It is perhaps the most versatile tool in the modern shop.

Grinding—Drum and disc sanding—Rotary filing—Wire brushing—Buffing—Polishing—many other operations—all done with one Haskins Portable Flexible Shaft Machine. And done better, too—and faster—with less effort on the part of the operator. The result—a savings to you of both man power and machine hours. Send for details.

HC-5
½ H.P. Multi-speed countershaft unit. 900 to 3600 RPM. Bench-height pedestal. 360° motor swivel.

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Among the equipment needed in the construction of a chemical plant were several Venturi tubes of acid-resistant metal. Ampco Metal, Inc. made the body of Ampco Grade 15 sheet, the flange of Ampco Grade 16 (centrifugally cast), welded them with Ampco-Trode 10, and machined the flange surface . . . all in one plant . . . for a highly satisfactory corrosion-resistant assembly.

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Specialists in engineering—production — finishing of copper-base alloy parts.

If corrosion is one of your important problems, follow this time-tested and well-recommended procedure — *fabricate with Ampco Metal* and *weld with Ampco-Trode.*

In one completely-equipped and self-contained plant, Ampco Metal, Inc. can fabricate assemblies and sub-assemblies that resist corrosion, wear, impact, fatigue, erosion, abrasion, and cavitation. This time-and money-saving Ampco service merits your immediate investigation.

Experienced users tell us Ampco Metal lasts several times as long as ordinary bronzes under difficult conditions. Use this fact to your advantage. Ask Ampco engineers and production specialists to help you adapt fabricated assemblies of Ampco Metal to your requirements. Send us your prints for suggestions.

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installation of scientific management.

The test case illustrated in the above mentioned article stated an incident where permission for a day off was granted by the superintendent without even consulting the foreman. This, in my opinion, is definitely wrong. The authority to grant such special favors by the foreman is an asset to his job. More factories should adopt a program whereby no man could go above his immediate supervisor without permission unless it is a personal matter, and only then should he be granted a hearing. I honestly feel that plant superintendents should make it a point in all cases to call in the foreman to hear the full discussion.

In regard to hiring and firing authority, often times a foreman, if permitted to hire and fire his own employees, might be prejudiced for some minor detail that does not concern the amount and type of work that he can perform. And after all, this primarily is the reason a man is hired.

I think it is in order at this time to say that much ill feeling and dissatisfaction among the department heads can be avoided by having top management clearly define the duties, operational purpose and authority of each department to each and every person in the organization, thus avoiding incidents like those mentioned in your article.

Lyle Vinger

•

MOUTHPIECE OR MANAGER?

An answer to this question which appeared in your magazine depends on various conditions in a plant. There is no one answer for all cases. Some of the factors which will change the answer are: type of product and number of employees.

However, in most plants the efficiency is higher if many duties formerly assigned to the plant manager are relegated to another party.

Take, for example, a wage increase. In what we call "the good old days," quite often a man had his wages increased not because he showed himself to be a better workman but for some reason outside of the plant—maybe he was a cousin of a man who knew the lady which lived next door to where his father lived.

I remember that I once got a raise in wages because I played a violin (at least I thought I did) and the manager also played the same instrument.

The best method to decide whether a man should have an increase is from records carefully kept showing how the man meets Production Stand-

It's the kind of perfect-fit finish that's pretty sure to result when human skill and *The right file for the job* get together. In the operation above a Nicholson Long Angle Lathe File is being used to remove the last few thousandths inch of stock and then to give the shaft the final required smoothness.

Smooth-finishing, under light pressure, is the primary purpose of this very accurate Lathe file. But—increase the pressure ever so little and the same file will also do a good stock-removal job—faster, in fact, than a regular Mill file.

Lathe file vs. Mill file. Because of the 45° angle of its teeth, the Nicholson or Black Diamond Long Angle Lathe File overcomes filling up and consequently scratching the surface of the work—a tendency common in the shorter angle Mill Bastard when used as a "lathe" file. The chips slide down the gullets and are forced out at the edge by the motion of the work against the file. This not only makes the file self-clearing, but provides much cleaner shearing, eliminates drag or tear, prevents "chatter," assures much faster cutting.

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FREE to managements, production heads, purchasing agents and key mechanics—the Nicholson 48-page illustrated book, ***"File Filosophy,"*** on kinds, use and care of files.

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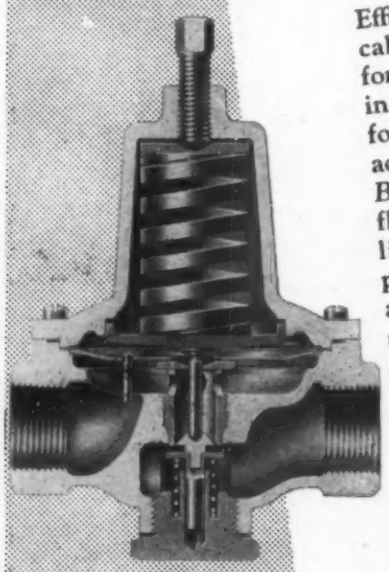
in the air line guarantee "balanced performance" of air tools and cylinders under any working condition.

Efficient, compact unit automatically reduces line pressure to uniform working pressure. No surge in pressure to throw tool performance out of rhythm. Quickly adjustable over a wide range. *Bronze-synthetic diaphragm* for flexibility, quick action and long life. *Floating action* of diaphragm greatly reduces rupturing and shearing. *Syphon tube* assures greater volume of air or fluid to pass with less pressure drop than conventional regulators. Available for air, gas, steam, oil and hot or cold water.



Write for catalog 400. C. A. Norgren Co., 220 Santa Fe Drive, Denver 9, Colorado

Norgren

ards. This job can best be done by an outside department, rather than the shop superintendent or manager.

The same argument applies to advancing a man to a better position. Base your decision on records rather than the snap judgment of the manager. Such procedure is fair and stops much hard feeling among other employees in the department.

The matter of training is important. In my cub days the manager considered it part of his duties to show us every machine shop duty, even to how to hold a file when dressing a casting. Maybe that is why he was always in a mixup. He overlooked the duties which were important and worried too much over small details.

The efficient manager administers his department and allows the small details—important in their place—to be taken care of by other men.

The same is true about setting manufacturing standards. This work can be done better by an engineer who has had the experience. I have been in some shops where the manager has attempted to do this job and the way standards have been changed, up and down, it looked like a temperature chart of the weather in New England.

Well, now what have we left for the manager to do. He will find enough, meeting shipping schedules, rerouting jobs until the production department can get the wires straightened out, and a host of jobs.

He is not losing any of his prestige by releasing the duties, here mentioned, to other men who can devote the attention which each should have. The day of the one-man shop is a thing of the past.

Robert Mawson
Providence, R. I.

•

MOUTHPIECE OR MANAGER?

I am not bragging of 35 years of machine production experience, embodying automatic screw machines every phase, tool work, estimating, and supervision. Whether you rate me as a competent authority on the subject of foremen depends entirely upon what you think of my thesis on the subject.

I have never been employed by a firm where personnel handled all relation problems, however if such a system exists, then the foreman is not a foreman, because Noah Webster says "Foreman—the superintendent of some department of a business."

Then this man under that system or management policy is a tool setter or setup man, whose proficiency qualifies him to set up and maintain tooling,

A SIGNAL SUCCESS WITH PLASTIC LAMINATES

NO IFS, ANDS, OR BUTS about it . . . railway signal equipment must be dependable year in, year out. And that calls for electrical parts resistant to temperature changes and severest atmospheric conditions—parts like the terminal block shown below, made from a plastic laminate based on BAKELITE resin. Proved along the railways of the world, this insulation material gives you the green light and a clear track to topmost dependability for a vast number of applications.

There's a whole line of BAKELITE resin-based laminates to choose from. Included are types made of paper, fabric, asbestos, glass cloth, and glass fiber—in convenient forms, such as sheets, tubes, rods, and molded shapes. All have unusual dielectric strength, outstanding dimensional stability, and the machining ease that spells economical production. Beyond that, each has its own aggregate of properties that are adaptable to special service conditions.

Write Department 31 for your copy of Booklet C-1, "BAKELITE Laminating Plastics," which describes standard NEMA grades of plastic laminates. Also, request Road Map Booklet No. 4, which presents, in condensed form, valuable information on the many other types and forms of BAKELITE dielectric plastics in addition to the laminating products described.

Be sure to visit Bakelite's exhibit, Booths 68 and 69, SPI National Plastics Exposition, Grand Central Palace, New York City, April 22-27.

BAKELITE PLASTICS

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NOW—2 NEW EXTRA HEAVY NEW-FIELD *Universal* FLY CUTTERS

DESIGNED ESPECIALLY FOR SHELL END MILL ARBORS

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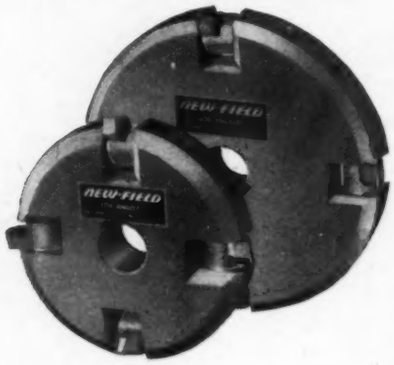

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A few of the many cuts which can be made IN ONE OPERATION with the New-Field Universal Fly Cutter

This new EXTRA HEAVY Cutter adds strength for heavier machining. Like other models it uses standard high speed steel or carbide bits—eliminates need for special cutters—speeds production—cuts maintenance and down-time costs.

Fly-wheel action increases cutting momentum—gives more precise finish—less heating of the finished surface. Adaptable for high rate milling on all classes of metals and plastics.

The perfect form of multiple fly cutter—eases load and impact on milling machines, lengthens cutter life between grinds, permits more chip removal per horse power.

4" to 10" diameters—$\frac{5}{8}$", 1" and $1\frac{3}{8}$" (extra heavy) width.

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THE TREND IS TO NEW-FIELD

etc., and instruct operators if he is so inclined. His sole responsibility to his employer is to get on with his fellow workers. He must be tolerant and have the ability to establish friendship, which in turn comes back to him in the form of cooperation from the operator.

I believe the definition of the word "foreman" speaks for itself. As a matter of fact, the good foreman justly deserves the title of key man of industry. He must be considerate but firm. A foreman must be more than a competent production manager; he must be qualified as an interpreter of company policies, securing good results and establishing more firmly the friendship between employees and management. One of the most important duties of the foreman is the reception, and early training or education of new employees. No matter how skilled the newcomer may be, his impression of the management formed the first day he works is sure to have an influence on his future actions and attitude while on the job. The foreman's attitude can make or break a department, and trouble which affects a whole plant has often been traced to the actions of one foreman.

A foreman should have authority to cope with modern conditions, to make on-the-spot decisions, and to adjust human-relations problems. This relieves management of many duties, secures better production, loyalty and cooperation.

There is a considerable difference between the small business, with owner-manager close to every workman, and the large corporation with delegated management. Many times the labor policies laid down by management are entirely responsible for labor disturbances.

Last, but not least, a foreman, in order to be an asset to his firm must:

(1) Give fair treatment to the men, and be willing to see their side at all times.

(2) Have good morals, and set the example.

(3) Fight for the men, if he believes they are right.

(4) Give the men credit for good ideas.

(5) Advise management of worthy ideas advanced by the men.

(6) Maintain discipline.

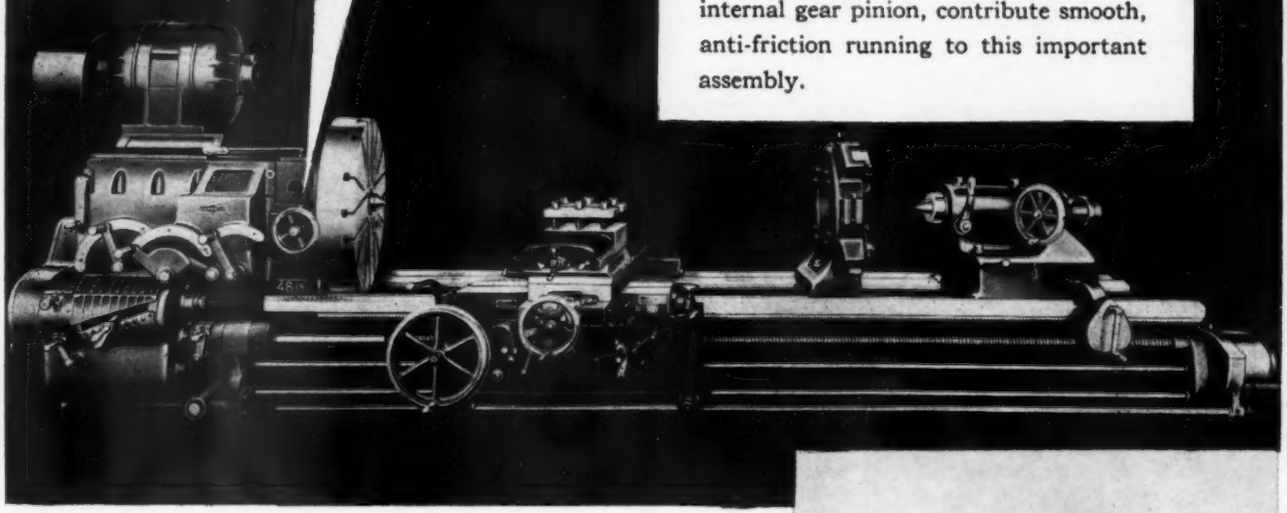
(7) Never play favorites.

While these would have once been considered minor qualifications, they now rank with the major requirements of ability to absorb company policies, a thorough and intimate knowledge of the work, and ability to

ORANGE ROLLER BUSHINGS

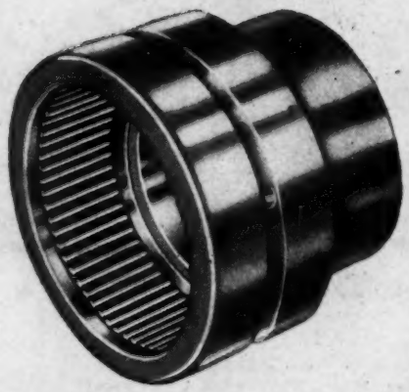
In the Internal Gear Pinions of "AMERICAN" LATHES...

The simplified headstock of 42" and 48" "American" Super Productive Lathes provides 18 spindle speeds with 16 gears, including the powerful face plate internal gear drive and pinion. Orange Roller Bushings, used in the mounting of the internal gear pinion, contribute smooth, anti-friction running to this important assembly.



ORANGE Roller Bushings are the choice of many of the nation's outstanding machine tool manufacturers. As precisely made as the finest machine tools, Orange Roller Bushings excel in smooth, quiet, long-life operation. Due to the minimum internal clearances maintained in Orange Roller Bushings, true running at high speeds is assured. Extremely high load carrying capacity in small space is provided.

Orange Roller Bushings are available in a full range of sizes and types for most requirements. Send for Engineering Data Book showing design, sizes, capacities, installation data, etc.



ORANGE ROLLER BEARING CO., INC.
544 Main Street, Orange, N. J.

Mail Coupon for Engineering Data

Orange Roller Bearing Co., Inc., AM
Orange, N. J.

Please send me your Roller Bushing Data Book.

Name.....Title.....

Company.....

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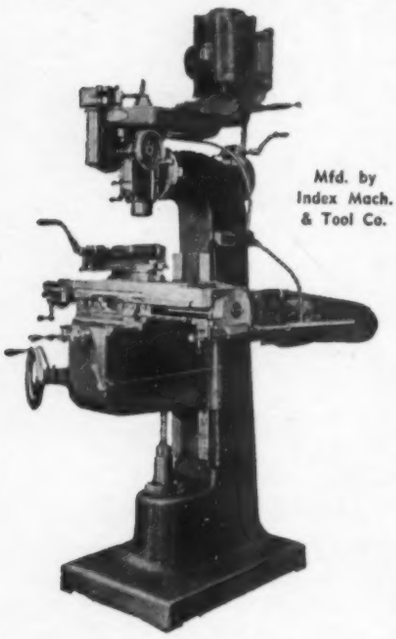
INDEX MILLS

will help you on your tool, die and production work. In addition to micrometer dials on screws, verniers are standard equipment for cross and longitudinal locating. If finer precision is desired, rods and indicators are available. These in conjunction with power feed to a precision ball bearing spindle make a very versatile machine for milling, drilling and boring. *Literature promptly mailed on request.*



Mfd. by Index Mach. & Tool Co.

12" Tool Room Rotary Table

A quality tool for precision work in the tool room or production line, incorporating such features as ball bearings—hardened and ground worm—quick acting throw-out for free hand turning—single movement table lock that does not cramp table out of alignment—compound trough. 12" size only.

For use on Index Mills or any other machine that will accommodate a 12" table.

BLANK and BUXTON MACHINERY

3100 E. MICHIGAN AVE.
JACKSON, MICH.

sense unrest before it becomes dangerous. I think that I have given you in this my opinion and classification of "When is a foreman not a foreman," and "What should a foreman's job be."

Robert M. Stone
Glendale, Calif.

•

On the Round Table subject, "Mouthpiece or Manager," it's the foreman's job to interpret management's policies and desires to the employees and to plan and manage his department economically so a profit will be realized. In return, management should respect the foreman's opinions and suggestions and cooperate with him so he can perform his duties easily and quickly.

Under no condition should a relative or friend of an executive be allowed to go over the head of the foreman to request special favors.

P. H. Pearson
Lynn, Mass.

TO THE EDITOR

I have read with great interest the article "How Not to Go Broke on Setup Costs" by Gregory J. Oberst, which you published in your magazine. This is a problem which interested me greatly some ten years ago, and in which I am thought by some people to be an expert.

Mr. Oberst's article is certainly very interesting, and it brings out several points which are undoubtedly quite important, although I must confess I cannot quite follow some of his arguments. I believe, however, that he has overlooked an extremely important point, namely, the burden of storage charges resulting from large lots. This is a very common error, and I believe has resulted in many companies making lots which are too large from an economic viewpoint.

It is true that in the very first page Mr. Oberst states that his minimum run is not exactly the same as an economic lot size, or, at least, that his value is not arrived at in a strictly textbook manner. I believe, however, that he should be concerned with what is generally called the economic lot size because on Page 1 he stated that the second step for a manufacturer is to decide to manufacture in economical quantities in anticipation of demand and in the next paragraph he assumes that this is the goal of his discussion. Also in Segment 8 of Figure 6 he refers to the output in the bins which can only mean that the article is manufactured in advance of sale and stored.

I am taking the liberty of sending you under separate cover a copy of our Engineering Extension Division Bulletin on "Economic Lot Sizes in Manufacturing" which will explain why I feel that the charges incident to storage are so important. There are a good many mathematical calculations in this bulletin but the important point is not the mathematics of the determination of economic lot sizes but rather the fact that lot sizes should be made as small as possible because of charges incident to storage and not as large as possible as advocated by Mr. Oberst, because of setup costs.

With increased mechanization, the matter of economic lot sizes becames constantly more important. I am glad you are willing to publish articles on this subject, and I am sure you will want me to call to your attention what I consider to be a serious omission in the article by Mr. Oberst.

Prof. Paul T. Norton, Jr.
Va. Polytechnic Institute

•

The triple-roller burnisher for locomotive crankpins in a recent issue is an interesting tool. While burnishing tools with two or three rollers (to relieve the strain on the lathe centers) have been used on a number of railroads, I have never seen the swiveling third roller used as a method of feeding. This has much to commend it.

It is, however, somewhat surprising to see a progressive railroad like the Pennsylvaina still using rollers on axles and crankpins when this method has been abandoned on a number of the smaller roads. Some years ago, the Salt Lake City shops of the Denver & Rio Grande introduced the grinding of all such bearings, as it was found next to impossible to get a round bearing by rolling.

While rolling of axle and crankpin bearings leaves a good surface and hardens the surface somewhat by the peening action, it is safe to say that no rolled bearing is really round. All that is needed to prove this is to take any crankpin after it has been rolled and put it in a grinding machine. A very light grind over the surface will leave considerable surface untouched by the wheel, showing spots of rolled surface below the true or normal diameter of the pin.

If the steel in the pin were absolutely uniform in hardness, this would not occur. But the softer portions are below the normal surface, resulting in a pin that is not round.

Frank C. Hudson

Available NOW on 24-Hour Shipment . . .

R317T, Reynolds new strong aluminum alloy free-machining

SCREW-MACHINE STOCK

Are your screw-machines hungry for stock? Men idle? Orders unfilled?

Then wire, write or phone us today for a supply of R317T, Reynolds new strong free-machining aluminum alloy screw-machine stock.

24-HOUR SHIPMENTS

R317T is now available in all standard sizes of rounds or hexagons for 24-hour shipment.

ADVANTAGES OF R317T

This new Reynolds Aluminum alloy is becoming famous for making any finished shape requiring free-machining. Weighing only ⅓ as much as steel or brass, it puts less strain on machine bearings—is easier on cutting tools—trims with small, free-falling, easily packed chips.

R317T COSTS LESS

Finished products of R317T cost less than brass because of light weight and small loss in cutting. Often you get a *better* finished product from this sturdy, durable, war-developed alloy.

R317T is superior to other aluminum alloys for machining because all cold-drawing strains are relieved with a final heat treatment in finished form—minimizing warp during machining.

SOLVES YOUR PROBLEMS

Reynolds R317T is the new screw-machine stock that may solve your problems now. Save time along your line! Fewer rejects! Finer production faster, at lower cost.

For 24-hour shipments or information, get in touch with the nearest Reynolds office or write, wire or phone Reynolds Metals Company, 2523 South Third Street, Louisville 1, Kentucky. *Offices in principal cities.*

STANDARD STOCK AVAILABLE NOW

17S-T, Reynolds standard screw-machine stock also available on 24-hr. shipment.

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STRUCTURAL SHAPES

Quick shipment. Strong alloy aluminum rolled structural shapes.

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Early shipment on all types and kinds of aluminum forging stock or press forgings contained in an area 7" x 16". Engineering help in designing dies.

Consult Reynolds for Aluminum NOW

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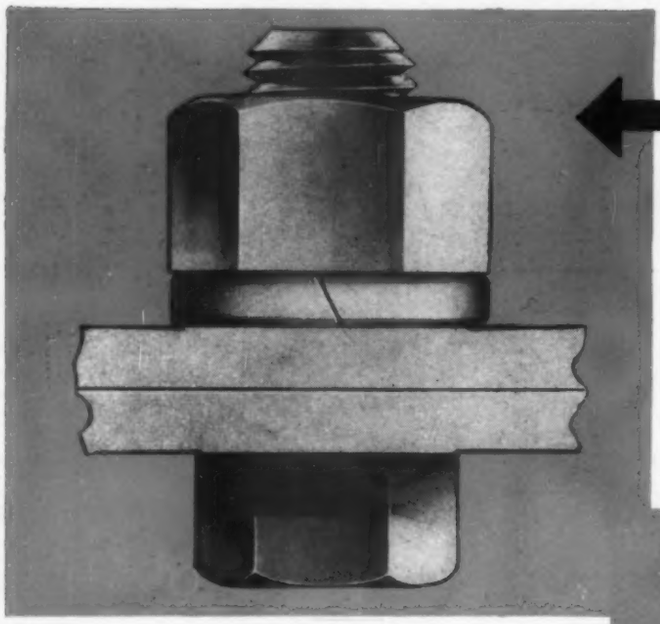
The Great New Source of

INGOT • BILLET • SHAPES • WIRE • ROD • BAR • TUBING • PARTS • FORGINGS • CASTINGS • FOIL • POWDER

For REAL Bolted Security... A SPRING Washer is a MUST



BEFORE WEAR

(Kantlink Compressed)

IT'S TIGHT

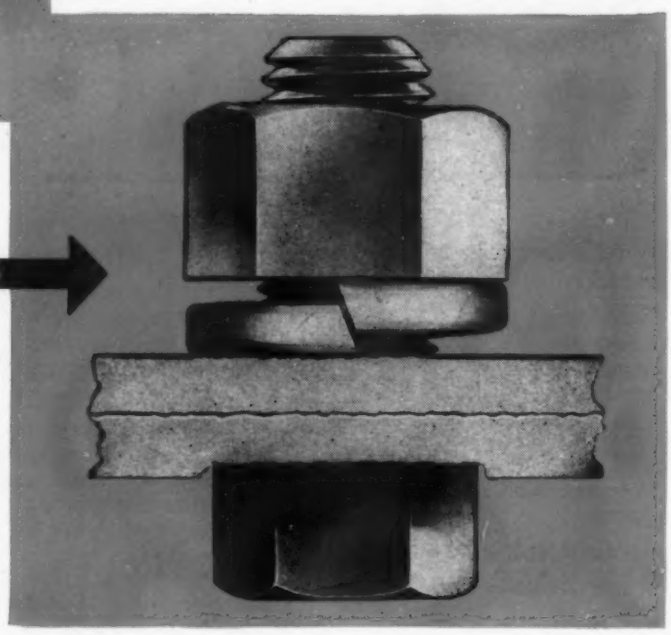
because you wrenched it TIGHT

AFTER WEAR

(Kantlink Expanded)

IT'S STILL TIGHT

because the Spring Washer expanded and held all parts Tight



Originators of KANTLINK the long-range spring washer

Since the advent of the castellated nut—a fixed nut—research has found that eventual looseness in bolted assemblies will be caused by the ductility of metal—by bolt stretch—and by inevitable wear at every contact point of metal surfaces.

Nut locking devices—although they may keep the nut from turning—do not and can not give the necessary spring action that keeps other parts of bolted assemblies tight. Vibration and stress loosen everything—they always have, and always will.

You should use a strong spring washer that expands as wear occurs. Expanding spring action retards initial wear, and then compensates for later wear to hold all parts tight longer. Nothing but a live spring can do this essential job.

There is no substitute.

For real bolted security specify Kantlinks.

Send today for descriptive folders.

THE NATIONAL LOCK WASHER COMPANY

Newark 5, New Jersey — Milwaukee 2, Wisconsin

Engineered Hole Location Service Speeds New Dies to Your Pressroom

BRINGS INTERCHANGEABILITY TO TOOLMAKING

Die, stripper and punch plates of complex tools and dies can now be produced *concurrently* by several toolmakers on an interchangeable parts-and-assembly basis instead of progressively as a one-man job.

Yes, mass-die production is now possible, with the Moore Jig Borer and Moore Jig Grinder working together as tool room partners.

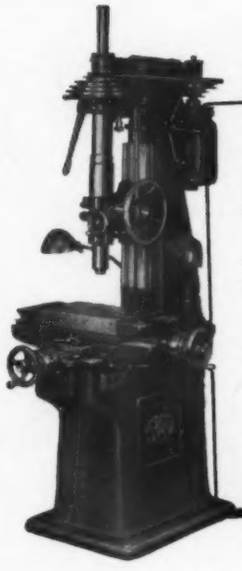
Take this 10-station hardened progressive die, with 100 holes to be located, bored and ground to .0002″ tolerance in the die and stripper inserts. Using old methods, this would require about 2,000 man hours and six months to complete.

With the Moore Jig Borer and Moore Jig Grinder working to pre-engineered dimensions, all parts of the die were manufactured *to figures instead of to "fit"*... bored and ground in single set-ups on each machine. The diemaker merely assembled the parts.

Total man hours: 1,000, Delivery: 5 to 6 weeks

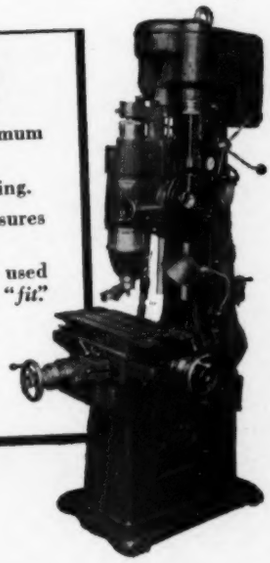
Mass-die production lowers tool costs, increases toolroom capacity, prolongs tool life and extends the ratio of productivity of operator and machine. One of our engineers will show you how Moore *Engineered Hole Location* fits your production scheme.

All holes are pierced and shaved, contour gutted and shaved.



HOW MOORE JIG BORER AND MOORE JIG GRINDER PROMOTE INTERCHANGEABILITY IN THE TOOLROOM

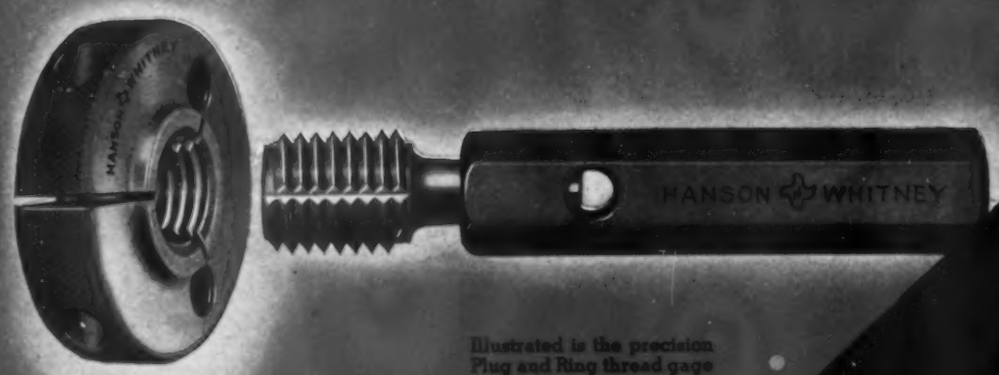
1. ***Moore Jig Borer spots, drills, bores or reams all*** holes with minimum tool changes.
2. ***Moore Jig Grinder relocates holes*** in hardened parts by finish-grinding.
3. ***Accurate Lead Screw Measuring Principle*** in both machines assures precise, rapid table settings within .0001″ by coordinate location.
4. ***Coordinate calculations made by engineering department*** are used throughout in boring and finish-grinding *to figures instead of to "fit."*
5. ***Soft and hardened parts are made concurrently,*** not progressively. Errors in hardened parts are corrected, not retained and transferred to other parts.
6. ***Both machines inspect own work*** without disturbing set-up.



MOORE JIG BORER (MOORE TOOLS) **MOORE JIG GRINDER**

MOORE SPECIAL TOOL COMPANY, INC. • 738 UNION AVENUE, BRIDGEPORT 7, CONN.

FOR LOW-COST THREAD INSPECTION
Specify "HANSON PROCESS" GAGES



Illustrated is the precision Plug and Ring thread gage AGD. Std. . . . available in N.C. and N.F. standard sizes from stock.

In volume inspection, these long-life thread gages are unexcelled for low cost efficiency . . . unsurpassed for accuracy, hardness and durability. The Hanson Whitney line of gages for both external and internal threads is COMPLETE.

Write, wire or phone your gage requirements, today, to the Small Tool Division.

Hanson Whitney

MACHINE COMPANY

HARTFORD • CONNECTICUT

THE MIRACLE BRUSH OF 1001 USES

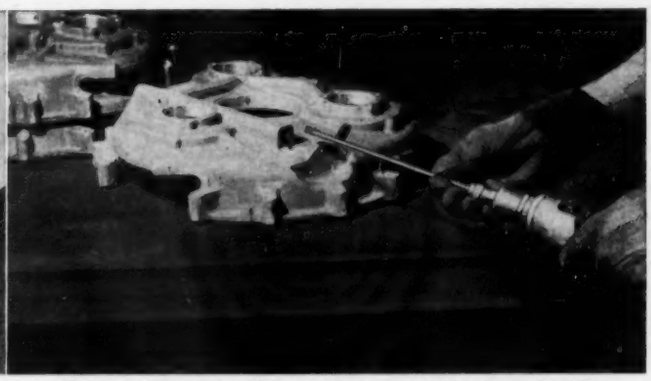
OSBORN'S REVOLUTIONARY NEW POWER BRUSH—THE SITUFT—COSTS 17¢—HAS SAVED THOUSANDS OF DOLLARS

Mounted directly in a drill press chuck. Situft is quickly removing burr from a small machined part.

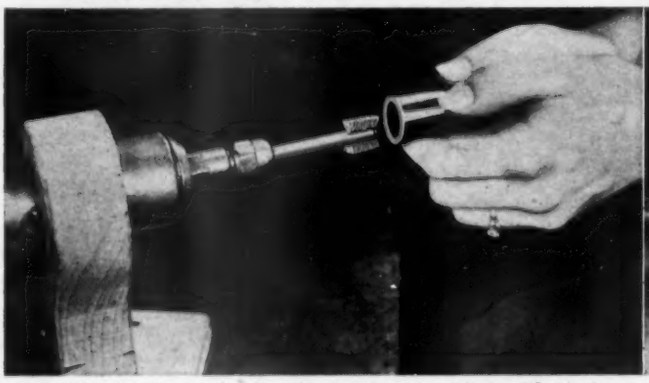
For deburring....scale removal....thread cleaning....removing rust, corrosion and foreign matter, etc., from hard-to-reach places. Can be used on any high speed drill press, portable tool or bench grinder.

NOW AVAILABLE FROM YOUR LOCAL OSBORN DISTRIBUTOR

Inserted in a special mounting, Situft is removing burrs and sharp edges from two threaded surfaces in a single operation.



Deep cavities in castings easily and quickly cleaned with Situft and portable tool.



Inside cleaning and deburring is simple and fast with Situft.

Extra deep cavities being cleaned on a lathe with Situft.

Special tool crib kit of 12 brushes {1 of each size—¼" to 1¼"} plus 2 holders: $2.85.

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Osborn Brushes

WORLD'S LARGEST MANUFACTURER OF BRUSHES FOR INDUSTRY

What's Jack & Heintz doing?

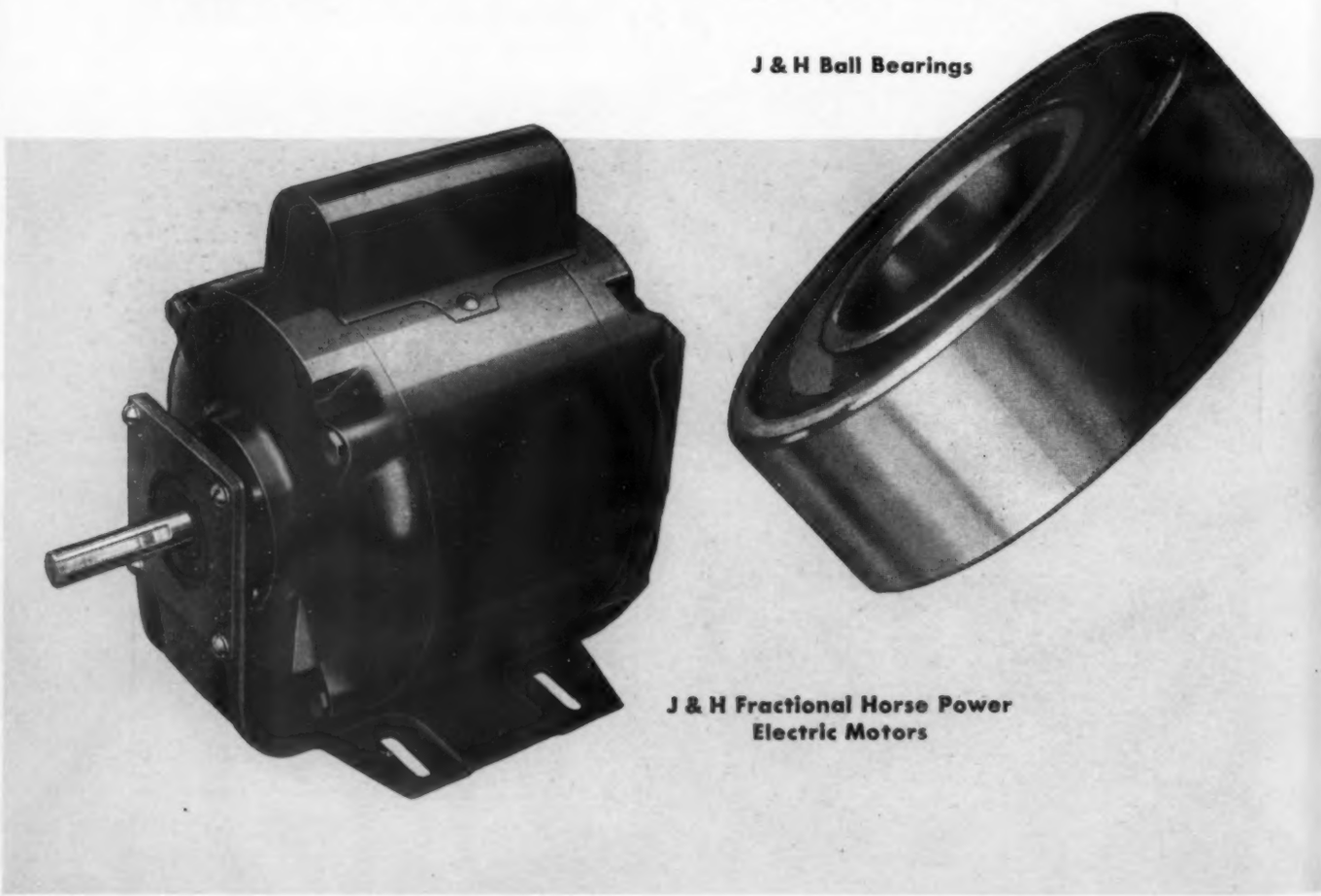
Busy manufacturing the things you see on this page. All (except the engine, which is still under test) are pouring off our production lines—lines that the war proved can turn out precision products in mass-production speed and quantity.

During the war Jack & Heintz made many of the most delicate instruments our Air Forces used—and had to make them in larger quantity and less time than had ever before been possible. And Jack & Heintz did it.

This skill-in-quantity, this precision-in-volume, is now being applied to the products shown here, and will be used to manufacture others soon.

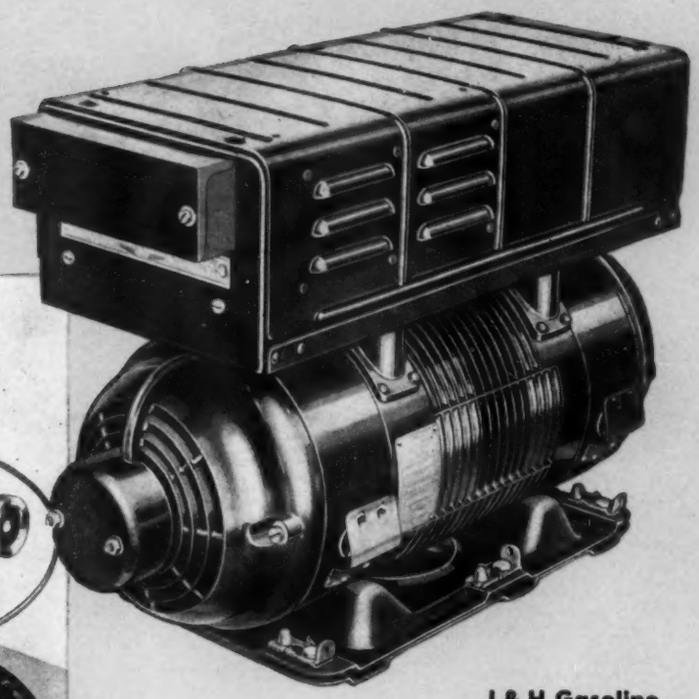
Our pledge to peacetime customers is the same as our pledge to the Air Force—every product bearing our name will be made with the same skill and care as the products on which lives depended—and depended safely—in the war. Jack & Heintz, Inc., Cleveland, Ohio.

J & H Ball Bearings



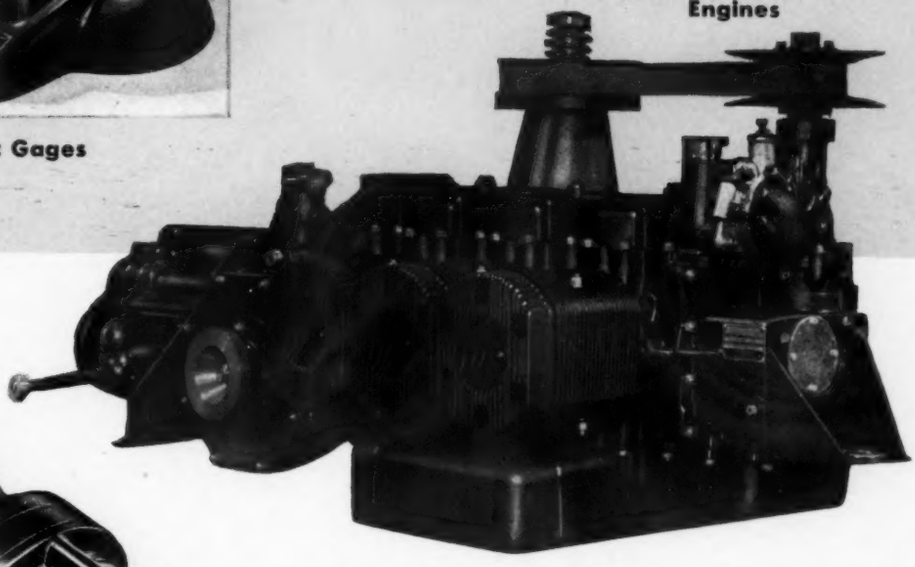
J & H Fractional Horse Power Electric Motors

2500 Volt Ampere Inverter



J & H Electronic Gages

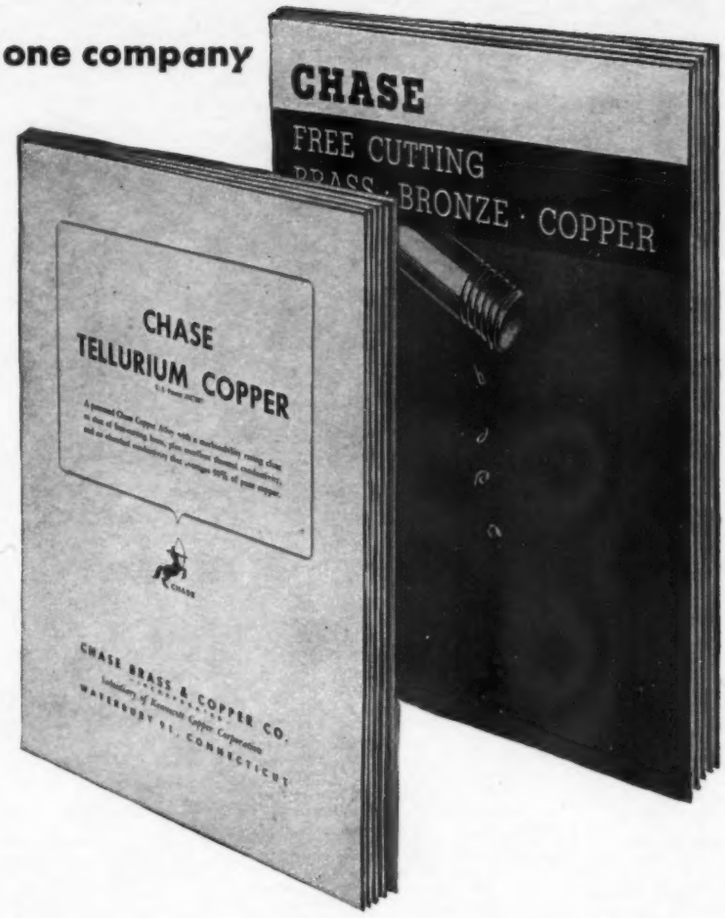
J & H Gasoline Engines



JH-6 Light-weight Aircraft Starter

JACK & HEINTZ
Incorporated

How these two books helped one company



to solve a fabricating problem . . . stop tool breakage . . . and speed production

(with an assist by the Chase representative)

A subcontractor was having difficulty with some 1⅞" Tellurium Copper rod. His telephone message was turned over to the Chase salesman.

When our man arrived at the plant he found that the subcontractor had been putting a slot in the Tellurium Copper rod, using a milling machine and high speed tool steel. Result: tools were constantly being broken, and production lagged.

So the salesman suggested that stellite or carbide tipped tools be used, pointing out that Tellurium Copper does not have the lubricating qualities of leaded copper alloys, (see booklet, CHASE FREE CUTTING BRASS, BRONZE AND COPPER, page 11). He also talked informatively about machine speeds (booklet, page 19).

The Tellurium Copper worked perfectly when the subcontractor tried these suggestions. It was a case of the right metal but the wrong kind of cutting tools to go with it.

★ ★ ★

It's part of every Chase salesman's job to understand the customer's fabricating problems, and be able to suggest better ways of working with Chase brass mill products when occasion demands. Often, however, you may save yourself valuable time by referring to one of our technical books.

For a complimentary copy of TELLURIUM COPPER, FREE CUTTING BRASS, or any other booklet by Chase (an outline of your problem is sufficient), write to Dept. AM-46.

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This is the Chase Network—handiest way to buy brass

A USER TELLS WHY MEEHANITE

Air Products, Inc., Chattanooga, Tennessee, manufacturers of a unique oxygen generator, make extensive use of Meehanite Castings as illustrated.

When asked to give their reasons, they tabulated an interesting report covering important parts for their expansion engine.

The Meehanite Castings used in the unit are displayed and the completed equipment is shown at lower right.

Air Products
...INCORPORATED

MANUFACTURERS OF
EQUIPMENT FOR THE PRODUCTION AND USE OF OXYGEN · NITROGEN · HYDROGEN · ACETYLENE

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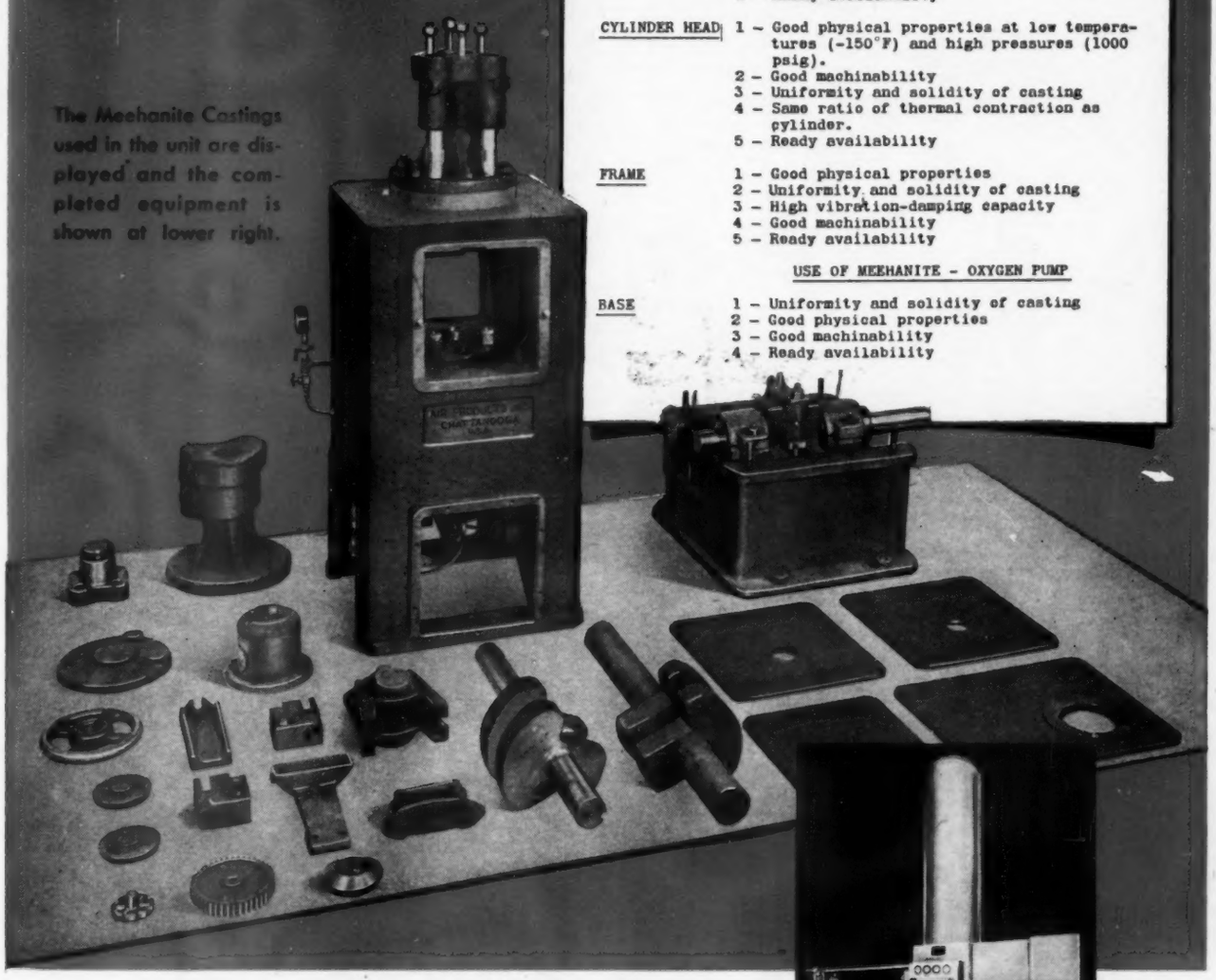
December 29, 1945

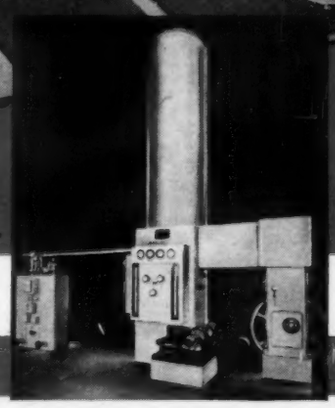
USE OF MEEHANITE - EXPANSION ENGINE

CRANKSHAFT	1 – Used to replace forged-steel crankshafts, which are difficult to procure. 2 – Easier to machine 3 – Less expensive 4 – Satisfactory shear strength 5 – Uniform solidity
CYLINDER	1 – Good wear characteristics at low temperatures (-150°F) and high pressures (1000 psig). 2 – Good physical properties at low temperatures (-150°F). 3 – Good machinability 4 – Uniformity and solidity of casting 5 – Ready availability
CYLINDER HEAD	1 – Good physical properties at low temperatures (-150°F) and high pressures (1000 psig). 2 – Good machinability 3 – Uniformity and solidity of casting 4 – Same ratio of thermal contraction as cylinder. 5 – Ready availability
FRAME	1 – Good physical properties 2 – Uniformity and solidity of casting 3 – High vibration-damping capacity 4 – Good machinability 5 – Ready availability

USE OF MEEHANITE - OXYGEN PUMP

BASE	1 – Uniformity and solidity of casting 2 – Good physical properties 3 – Good machinability 4 – Ready availability



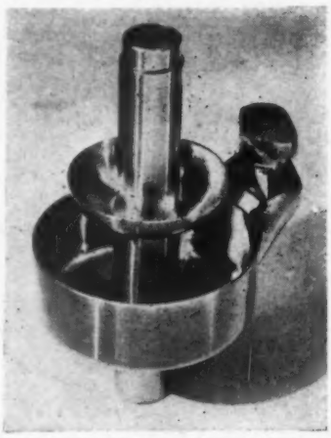


MEEHANITE RESEARCH INSTITUTE
NEW ROCHELLE, N. Y.

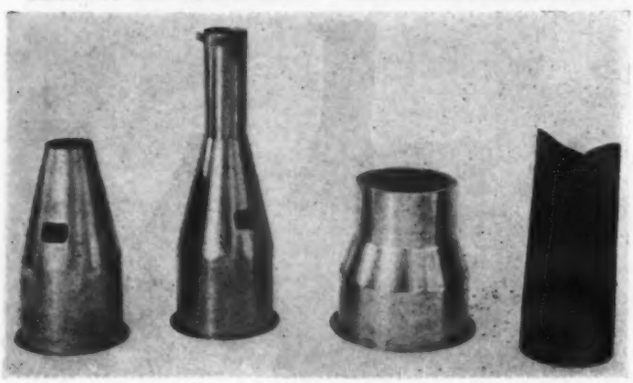
YOU CAN ELIMINATE COSTLY DIES IF YOUR SHAPE IS CONCENTRIC

(and diameter does not exceed 10 feet)

For experimental parts spinning is unexcelled. Flexibility permits changing forms as designs progress. There is no waiting for complicated dies, etc. — work can progress shortly after ordered. Important characteristics not obtainable by other methods are inherent in spun parts.



AFTER THE EXPERIMENTAL PART IS APPROVED, BERGFELS CAN ECONOMICALLY PRODUCE THOUSANDS MORE!



● As pioneers in the art of intricate metal spinning our engineers have successfully solved many "tough" assignments. The versatility of spinning, in the hands of trained Bergfels craftsmen, provides for both experimental and production parts at low unit costs.

Unlimited "streamline" shapes are also possible in spun sections or assemblies. The visualization of product dreams is available to everyone with the speed and economy afforded by spinning.

For complete information on how Spinning can be used to your advantage, write engineering department.

Facilities for deep drawing—including a 400 ton hydraulic press.

Illustrated Bulletin 15 is available now.

WILLIAM BERGFELS & CO.
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Metal Spinning

TO EXACT TOLERANCES . . . IN STAINLESS STEEL, MONEL METAL, ALUMINUM, COPPER AND ALL DUCTILE METALS

1846 — One hundred years of continuous service to industry — 1946"

AISI HY-TEN SAE

ALLOY STEELS FOR RECONVERSION

To take advantage of up to the minute development in the metallurgy of steel before improvements can be incorporated in the natural course of events in standard steels, specify HY-TEN STEELS.

Immediate shipment from seven conveniently located stocks.

Data sheets gladly mailed on request.

"THE HY-TEN OF TODAY IS THE STANDARD STEEL OF TOMORROW"

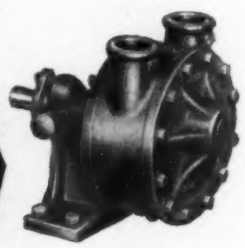
Wheelock, Lovejoy & Co., Inc.

128 Sidney Street Cambridge 39, Mass.

Cleveland 14 — Chicago 23 — Newark 5 — Detroit 3
Buffalo 10 — Cincinnati 32

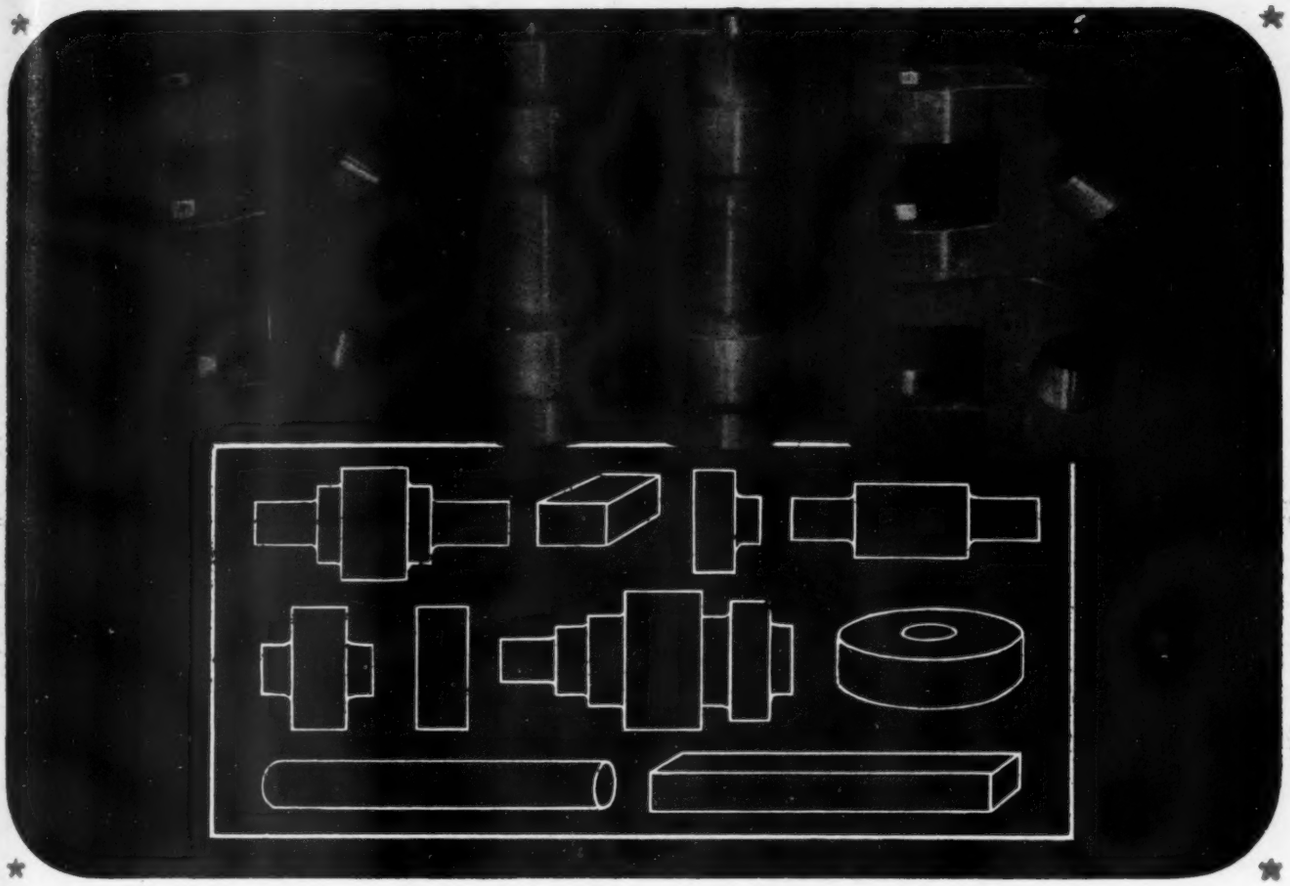
TUTHILL MEANS *Dependable* SMALL PUMPS

For General Purpose, Save Money With MODEL C



Compact and built for rugged service on non-corrosive liquids, Tuthill Model C is outstanding as a general purpose pump. Low in first cost and engineered for long service with negligible maintenance, this positive displacement, internal gear rotary pump operates efficiently in either direction of rotation. Capacities from 1 to 200 g.p.m. at pressures up to 100 p.s.i. Direct drive, belt drive, V-belt units and stripped models available. Write for Model C bulletin.

TUTHILL PUMP COMPANY
939 EAST 95TH STREET • CHICAGO 19, ILLINOIS



STAINLESS STEEL FORGINGS

to your specifications

- **RINGS**
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- **SPECIAL SHAPES**
- **BLOCKS**
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HEAT TREATING

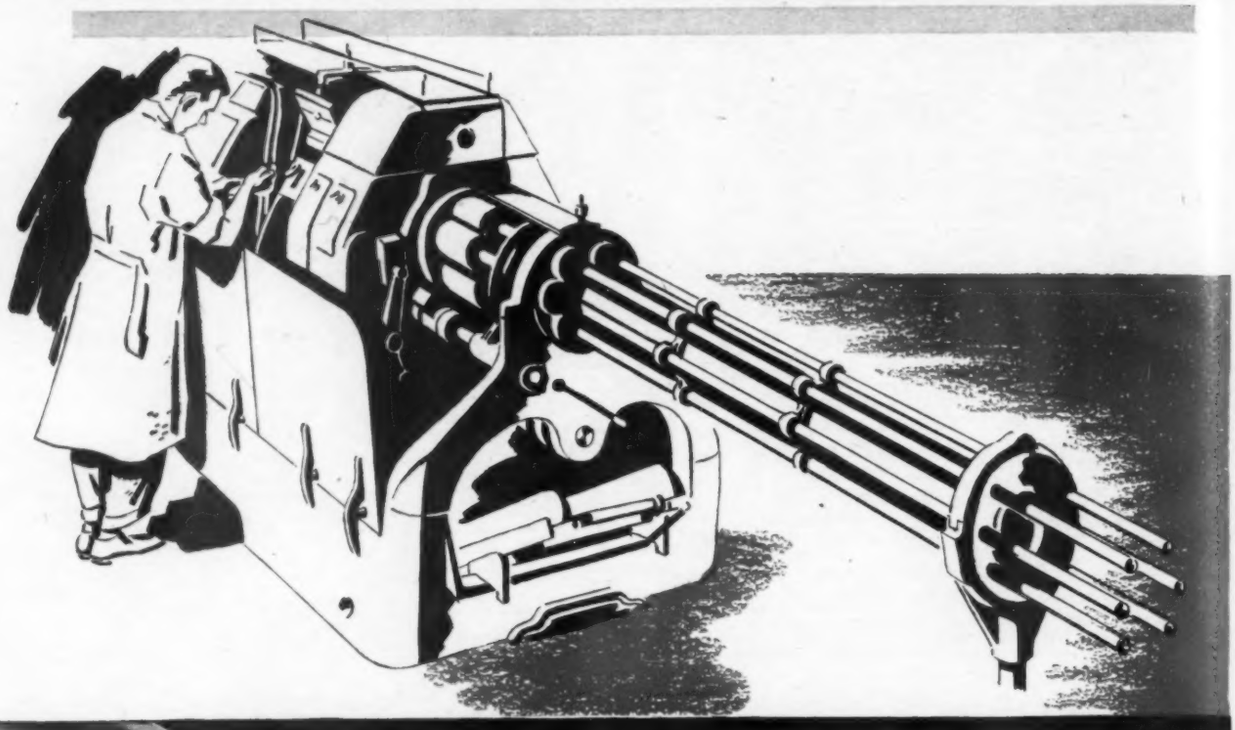
Any Allegheny Ludlum field representative will gladly give you further particulars, or write us direct.

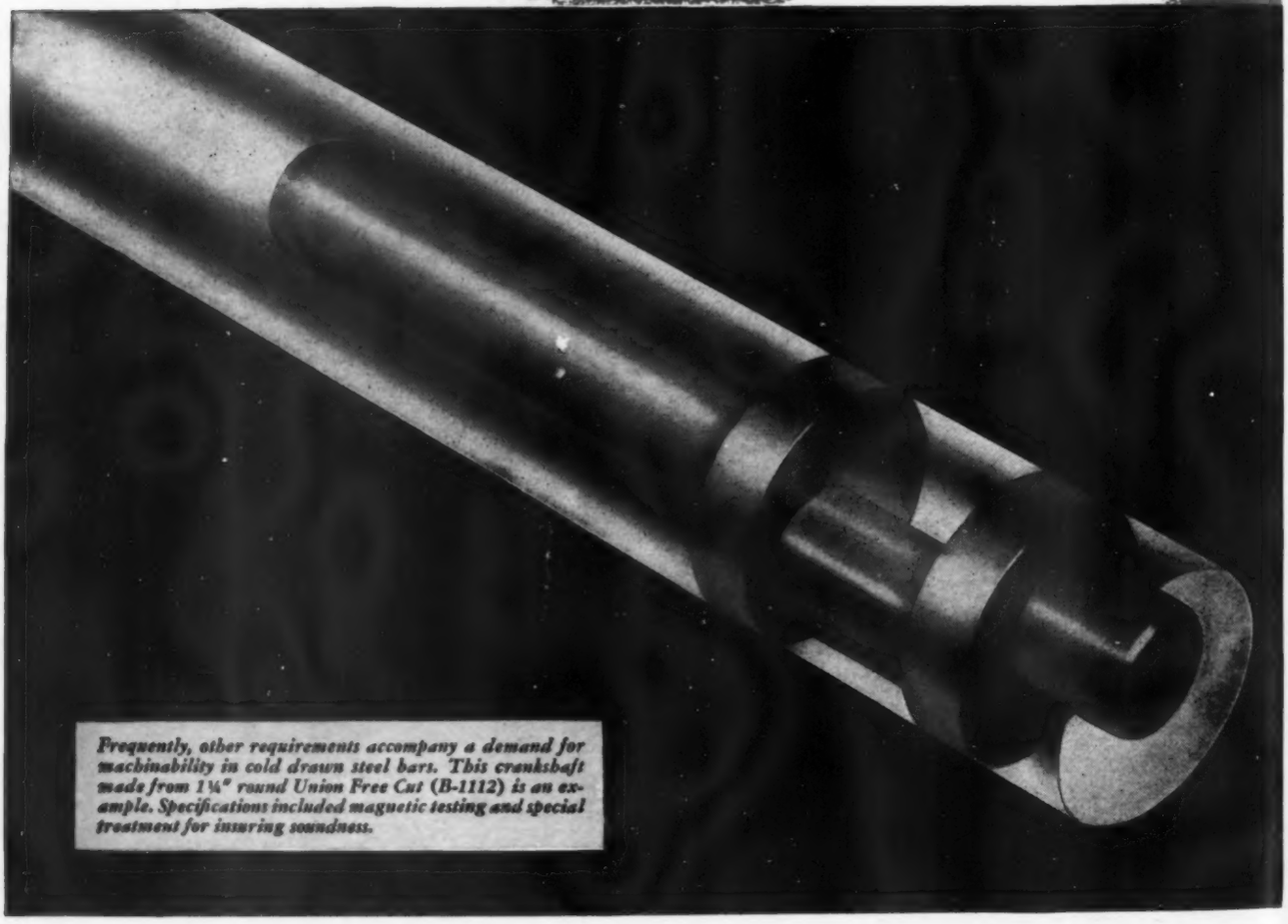
Address Dept. AM-50

ALLEGHENY LUDLUM
STEEL CORPORATION
Forging and Casting Division
Detroit 20, Michigan

W. & D. 9831-C

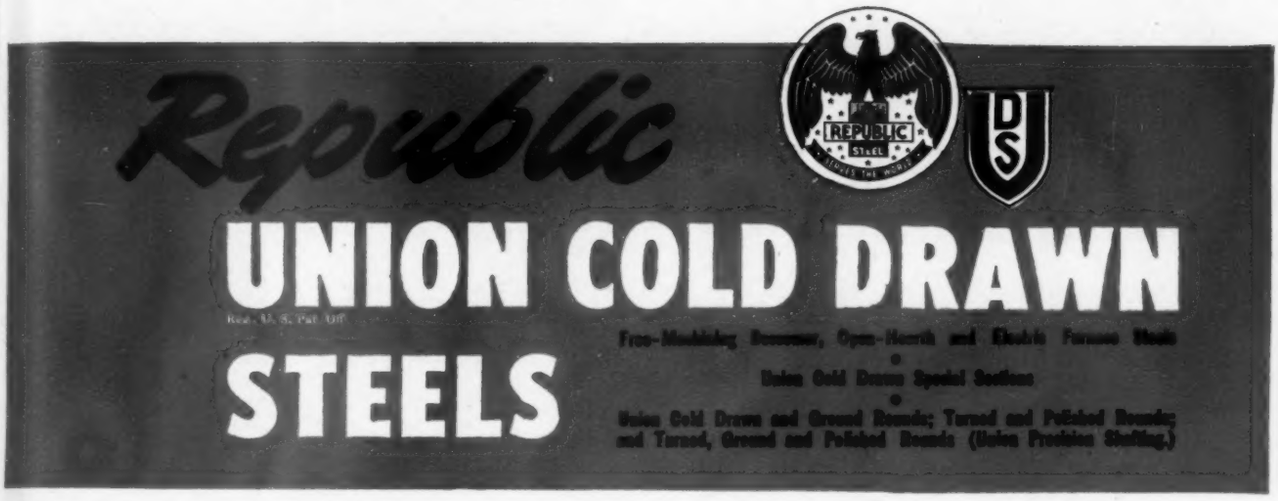
If MACHINABILITY





Frequently, other requirements accompany a demand for machinability in cold drawn steel bars. This crankshaft made from 1¼" round Union Free Cut (B-1112) is an example. Specifications included magnetic testing and special treatment for insuring soundness.

determines your rate of output, your costs and your profits, you need...



If you make duplicate steel parts from bar stock on a mass production basis, you need all the MACHINABILITY you can get in steel bars today.

And you'll find it in Republic Union Cold Drawn Steels.

Because of its vital importance in steel parts manufacture, MACHINABILITY *always* has rated above everything else at Union Drawn.

Metallurgists constantly seek new ways to improve it. Engineers study the performance of steels in order to fully utilize their machining qualities. And the workmen who produce the steels employ every modern method and control to insure maximum and uniform MACHINABILITY—including complete facilities of the latest type for furnace treatment.

That's why Republic Union Cold Drawn Steels produce steel parts with such smooth machined surfaces—at high speeds and heavy feeds—while extending tool life.

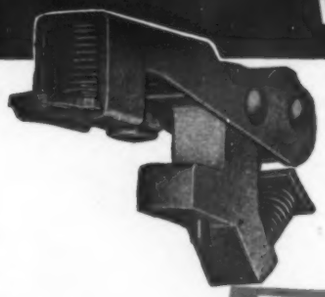
That's why users of these steels can realize the highest rate of output at lowest cost—resulting in greatest possible profits.

And that seems to be a very good reason why you should specify Republic Union Drawn Steels on every order for bar stock. If you need further reason—remember that Republic metallurgists and engineers always are ready to help you achieve top efficiency, output, quality and rock-bottom unit cost with these steels.

REPUBLIC STEEL CORPORATION
Union Drawn Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

MID AMERICA EXPOSITION CLEVELAND

"3C" *Simplifies* FOOT SWITCH MAINTENANCE *with* STANDARD CONTACT FINGER



Type FSA-22, 2 Pole, Horizontal Mounting, Left Side Operation, Open View.

Type FSVA-11, 22 or 33, 1 or 2 Pole, with Latch. Vertical Mounting.

ONE CONTACT FINGER ASSEMBLY FITS THEM ALL!

● Minimum maintenance—even on such a small part as this moving finger assembly, helps speed production and reduce costs. The contact finger assembly illustrated fits every one of the foot-operated switches illustrated—also Bulletin 101 Master Switches, Bulletin 102 Cam Limit Switches, Bulletin 102 Hatchway Limit Switches, and Bulletin 102 Track Type Limit Switches. Thus, in plants using several different types of switches, maintenance is simplified because the same spare part fits them all. Double break silver-to-silver contacts, requiring no filing nor dressing since oxidization will not cause poor contact, also reduces maintenance. When replacements are needed, a simple twist of the fingers removes the contacts and the pressure spring will not fly out.

Write for "3C" Bulletin 101-FS.

Showing Safety Shield and Floor Plate available on 1 or 2 Pole Switches only.

Type FSA-44 4-Pole.

Type FRSA-44 4-Pole, 3 position.

Type FWLSA-22—2 Pole Sequence operation, with Latch.

THE CLARK CONTROLLER CO.

1146 EAST 152nd ST., CLEVELAND 10, OHIO • EVERYTHING UNDER CONTROL

8 IMPORTANT REASONS—

Why It Will Pay You to Specify

RELIANCE Series "C" MOTORS

1. **Protecting enclosures** keep out dirt, chips, oil, excess moisture.
2. **Steel stators for strength.**
3. **Thirteen-step winding treatment,** for maximum stator protection.
4. **Pressure cast aluminum rotors** provide trouble-free windings.
5. **Heavy shafts,** liberally designed for added strength.
6. **Precision bearing mount** affords *real* protection to bearings and windings.
7. **Optional lead outlet arrangement** permits machine mounting with elimination of conduit box.
8. **Flange and face type brackets** offer alternative methods of machine application.

Write today for Bulletin C-118 which gives more complete details on these 8 advantages and offers many additional reasons why it will **pay you** *to specify Reliance Series C Motors.*

RELIANCE ELECTRIC & ENGINEERING CO.

1075 Ivanhoe Road — Cleveland 10, Ohio

Birmingham • Boston • Buffalo • Chicago • Cincinnati • Denver • Detroit
Gary • Greenville • Houston • Kalamazoo • Kansas City • Knoxville
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RELIANCE A-C D-C MOTORS

MAXITORQ FLOATING DISC

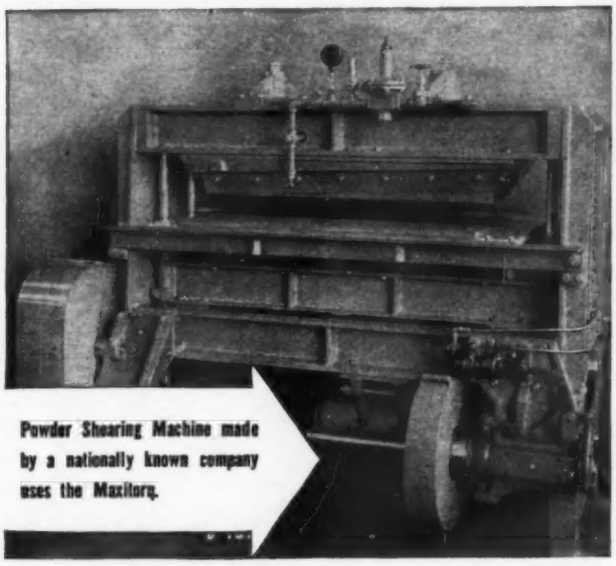
IF YOU NEED *Instant Overload Release* ... the MAXITORQ-CLUTCH *is your buy*

Certain types of high speed automatic machinery which handle breakable or damageable products require fast disengagement in event of overload. To meet these demands we have perfected and incorporated an entirely new action into the Maxitorq Floating Disc Clutch. It may be manually adjusted to a sensitivity that will instantly disengage the clutch at any overload condition.

Note the cams on the photograph at left . . . which instantly and automatically slip the clutch positively into neutral.

TESTED AND PROVEN

While the Maxitorq Automatic Overload Release Clutch is new, several leading machinery manufacturers report that careful tests under high speed operation have clearly proven its definite advantages in preventing damage to work and equipment. This is especially true, for instance, on machines which label bottles or process other breakable objects.



Powder Shearing Machine made by a nationally known company uses the Maxitorq.

ALL OTHER MAXITORQ FEATURES

This new clutch has the Floating Disc construction . . . "you can see between them" . . . no drag, no abrasion, no heating in neutral. Also . . . the entire clutch may be taken apart, assembled, and adjusted WITHOUT THE USE OF TOOLS.

CLUTCH CAPACITIES AND TYPES

The Maxitorq is made in both single and double types, wet or dry and in capacities from ¼ to 15 H.P. at 100 R.P.M. Pulley and Cut-off Coupling types are also available in the same standard capacities.

STANDARD SINGLE CLUTCH

This Maxitorq is used in the above machine . . . the Overload Release feature not being required. Machinery and machine tool builders from coast to coast find that Maxitorqs handle their power transmission problems "with the greatest of ease".

SEND FOR CATALOG NO. AM41

THE CARLYLE JOHNSON MACHINE COMPANY
MANCHESTER CONNECTICUT

TRADE MAXITORQ MARK

When the part that bearings play is marked "Pianissimo"

When an electric motor manufacturer says he wants quiet ball bearings, he's talking about vibration. Any noise is vibration. Even if it's too low for the sharpest ear, it's still enough to disturb the precise spacing of rotor and fields . . . when speeds reach 20,000 r.p.m. and better.

There's only one way to make sure ball bearings are that quiet . . . the way Fafnir does it. Inside a sound-proof room, with walls two feet thick, electric motor ball bearings are test-run with super-sensitive electronic instruments listening-in. If the needle moves past a dot on the dial, a bearing is rejected for noises you couldn't even hear.

And there's only one way to make ball bearings that can pass such rigid tests. Internal fits must be instrument perfect. Torque must be consistent at every point, at every speed.

Not that such exacting manufacture and testing is more than routine at Fafnir. It's Fafnir's way of putting the needs of industry first that makes so many industry men say, "Let's put it up to Fafnir first."

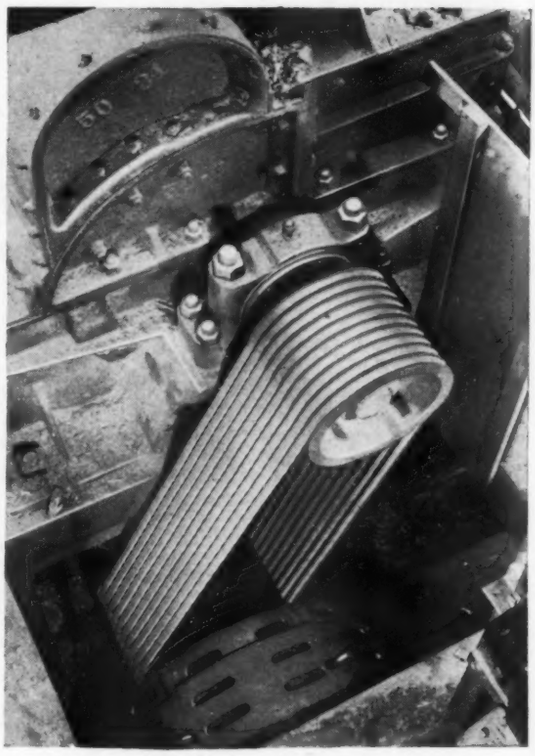
The Fafnir Bearing Company, New Britain, Conn.

MOST COMPLETE LINE IN AMERICA

FAFNIR BALL BEARINGS

The Reason for this Fact is worth knowing

Your GATES VULCO ROPES are Today Making Performance Records NEVER EQUALED Before!



No V-belts built by *anyone* before the war had anywhere near the strength and durability that was found necessary on U. S. Army tanks, tractors and self-propelled big guns in combat service. Gates developed these greatly superior V-belts for Army use—and here is why this fact is important to industrial users of V-belts:—

Here is the reason

Every improvement developed by Gates for U. S. Combat Units — and many later improvements, also—have been added, day by day, to the quality of the Standard Gates Vulco Ropes which have been delivered to you.

That is why, *long before the war was over,* you were getting in your Standard Gates Vulco Ropes a product built to far higher service standards than any V-belts ever built by anyone before the war.

And that is not all of the story. Through continuing *specialized* research, the service qualities of these superior Gates Vulco Ropes have been still further improved as all of Gates facilities and energies have been returned to the service of industry.

These are the simple reasons why the standard Gates Vulco Ropes you are getting today are far and away the best V-belts Gates has ever delivered to you.

All Gates V-Belts are Built with *The Patented* CONCAVE SIDE

THE GATES RUBBER COMPANY

Engineering Offices and Jobber Stocks in All Large Industrial Centers

Gates

THE MARK OF SPECIALIZED RESEARCH

464

GATES VULCO ROPE DRIVES

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PORTLAND 9, ORE., 333 N.W. 5th Ave. DALLAS 2, TEXAS, 1710 N. Market St. SAN FRANCISCO 3, CAL., 170 Ninth St.

N·B·M BABBITT METALS

We Have the Right Babbitt for Any Need

The success of N-B-M Babbitt Metals is based upon three important factors:

1. Virgin metals, to insure stability and uniformity.
2. Proper proportioning, to provide adequate physical properties for specific service requirements.
3. Expertly controlled preparation; the art of blending requires precise knowledge and constant control.

Write us about your bearing problem —we have a babbitt to solve it.

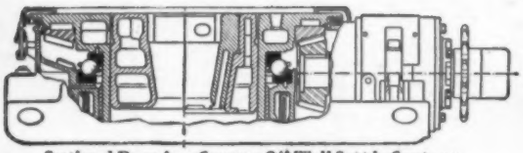
NBM

NATIONAL BEARING DIVISION

ST. LOUIS • NEW YORK

AMERICAN Brake Shoe COMPANY

PLANTS IN: ST. LOUIS, MO. • PITTSBURGH, PA. • MEADVILLE, PA. • JERSEY CITY, N. J. • PORTSMOUTH, VA. • ST. PAUL, MINN. • CHICAGO, ILL.



Sectional Drawing, Courtesy Oil Well Supply Company

TORRINGTON BEARINGS HELP INCREASE

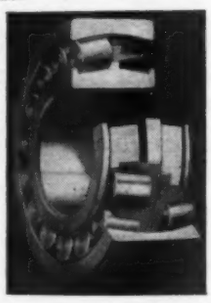
DRILLING SPEEDS

Increasing demands for faster oil production call for equipment that can take it. To increase service life and minimize maintenance in the rotary tables that control oil well drilling speeds, engineers specify the use of Torrington Angular Contact Bearings. Especially designed to carry both the radial and thrust loads imposed by high-speed drilling, these modern anti-friction bearings are rigidly controlled in the hardening and grinding processes to insure utmost precision and equalize load distribution under all service conditions.

Solving new or unusual bearing problems of the oil, steel, paper, machine tool and other specialized applications is all part of the day's work for the engineers of Torrington's Bantam Bearings Division. Profit by their diversified knowledge and experience by specifying Torrington Bearings when you order equipment.

THE TORRINGTON COMPANY • BANTAM BEARINGS DIVISION
SOUTH BEND 21, INDIANA

THE TORRINGTON SELF-ALIGNING SPHERICAL ROLLER BEARING



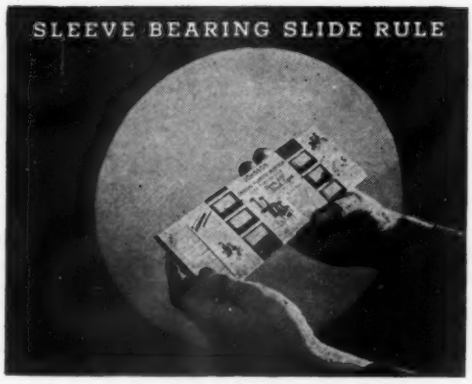
This latest addition to the Torrington line is a self-aligning bearing, specifically adaptable for heavy-duty performance. Sizes will be available to cover a complete range from 1.5748" bore and up. Write for further details or see your nearest Torrington Representative.

TORRINGTON BEARINGS

SPHERICAL ROLLER • STRAIGHT ROLLER • TAPERED ROLLER • NEEDLE • BALL

Stock Size

Bronze Bearings



For the Engineer

A Handy Sleeve Bearing Slide Rule that enables you to determine at a glance if your bearings are standard stock sizes. Write, on your business letterhead, for one. It's FREE.

● The trend among leading manufacturers is toward standardization. They have found, particularly with Sleeve Type Bearings, that it saves considerable time and money . . . simplifies ordering . . . provides excellent replacement service.

In Sleeve Type Bearings the easiest way to standardize is to specify *Johnson Bronze* G P. From our list of over 850 stock sizes it is possible to secure your entire requirements, machine finished, ready for immediate installation. Oil grooves, slots or holes are easily, quickly and economically added.

Why not compare your needs with our stock list? See for yourself the excellent service we offer on standard size bearings. Every Johnson G P Bearing is cast in the best general purpose bronze alloy available, machined to precise tolerances, entirely free from all defects of any nature. Write for our general catalogue TODAY.

JOHNSON BRONZE

SLEEVE BEARING HEADQUARTERS

The MOST COMPLETE SLEEVE BEARING SERVICE in the WORLD

515 S. MILL STREET NEW CASTLE, PA.

ALLEN TRU-GROUND

Dowel Pins

All you know to be symbolized by the ALLEN trade mark,—in metallurgy, precision workmanship, product-DEPENDABILITY, — all this applies to *TRU-GROUND* Dowel Pins *in these particulars:*

We make them of special-analysis ALLENOY steel, heat-treated to an extremely hard surface, with a core of the *right* hardness to prevent "mushrooming" when driven into a tight hole.

We grind them to a limit of .0002″ over basic size, with an allowable tolerance of plus or minus .0001″. Surfaces are finely polished; subsequently treated with a rust-preventive.

Their tensile strength is 240,000 to 250,000 psi. By their strength and accuracy they dependably *uphold* precision standards in tool, die and machine assemblies.

Ask your local ALLEN Distributor for samples and dimensional data . . . the same Distributor who serves you dependably with Allen Hex Socket Screws and other first-call mill supply items.

THE ALLEN MFG. COMPANY
HARTFORD, ★ ALLEN ★ CONN.

TORFLEX Flexible Bearings control vibration, silence noise and cushion shock.
They are widely used on all types of equipment, can be made in practically any size, low in cost, are simple and readily incorporated in new or existing equipment.
They provide for axial, radial and torsional flexibility and take care of misalignments. Once installed they require no care, no lubrication and work efficiently and dependably for years because of the high-grade special formula rubber used. In cases where the *TORFLEX* is subject to oil contamination an oil-resistant synthetic rubber is used.
TORFLEX Bearings are used in gears (see illustration below) to cushion shocks, prevent tooth breakage, reduce chatter, vibration and noise and by allowing torsional wind-up, they reduce starting loads.
Send in for more detailed information.

HARRIS PRODUCTS COMPANY
CLEVELAND 4, OHIO

Dragline scraper absorbing shock and vibration on heavy duty job. Each gear tooth carries over 4,000 pounds, yet Torflex bearing never slips.
Teeth on Punch Press worn to half original thickness. Torflex Protected Bronze Punch Press Drive Pinion still giving good service.

CUTAWAY SECTION OF PUSH-TITE AIR HOSE COUPLING

The REMARKABLE HANSEN PUSH-TITE COUPLING

The remarkable Hansen Push-Tite Coupling has won top honors as the outstanding coupling on the market based on its performance—economical performance. That is the reason why there are more Hansen Couplings used by large and small manufacturing plants than any other coupling. Its simplicity in design, ease of operation, "air savings" and long trouble free life means speed, increased production coupled with economy all along the line.

Hansen Push-Tite Coupling is unique in that it is easy and fast to operate, just a slight push of plug into socket—it's connected, locked and air is automatically turned on. Slide sleeve back with thumb it is unlocked, disconnected and air is automatically shut off. There is no turning, adjusting or twisting of parts in order to connect, disconnect or to turn air on or off. It's all done by an easy push on plug to connect and a slight push on sleeve to disconnect. Complete swivel action prevents kinking of hose. Hansen Couplings will handle pressures from a few ounces to over 10,000 pounds without leaking.

Hansen Push-Tite air hose couplings are used for air, oil and grease. There are also other Hansen Couplings made to handle gasoline, acetylene and oxygen.

Send for **FREE INDUSTRIAL CATALOG**

HANSEN MANUFACTURING CO

1786 EAST 27th STREET
CLEVELAND 14, OHIO

OUT OUR WAY. BY J. R. WILLIAMS

UH! HUH! DERE'S THE BULL O' THE WOODS RESTIN' HIS DOGS AGIN' AND CHEWIN' THE FAT WITH OLD PRECISION DAN
DON'T KID YA'SELF. HE AIN'T LOAFIN'. HE'S MAKIN' A TIME STUDY OF DAT NEW ALLOY SO AS TO HAVE ALL THE ANSWERS
J.R.WILLIAMS

The Old Bull Is Still Learning

War taught the Old Bull a lot... and he was plenty willing to learn. And he realizes there are always new things to learn about... new alloys, new tools, new methods... to assure the public of the best at the lowest cost.

Like the Old Bull, we consider it our job here at Ericsson constantly to keep abreast of new developments and methods so as to give you the best in service, *economically*.

ERICSSON

ESTABLISHED 1911

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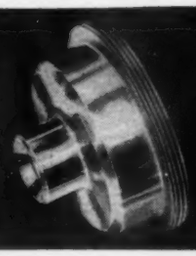
SCREW MACHINE PRODUCTS CO., INC.

25 LAFAYETTE STREET, BROOKLYN 1, N. Y.



TO RAISE PRODUCTION CUT COSTS

Specify

RUTHMAN GUSHER COOLANT PUMPS

MODEL TL 7320

There is no guesswork when you specify Gusher Coolant Pumps on your machines. You are assured of a coolant pump that is universally accepted by leading machine tool builders and designers.

If you want a pump that will cut costs and raise production in your metal cutting operations, specify the proven and original Ruthman Gusher Coolant Pump.

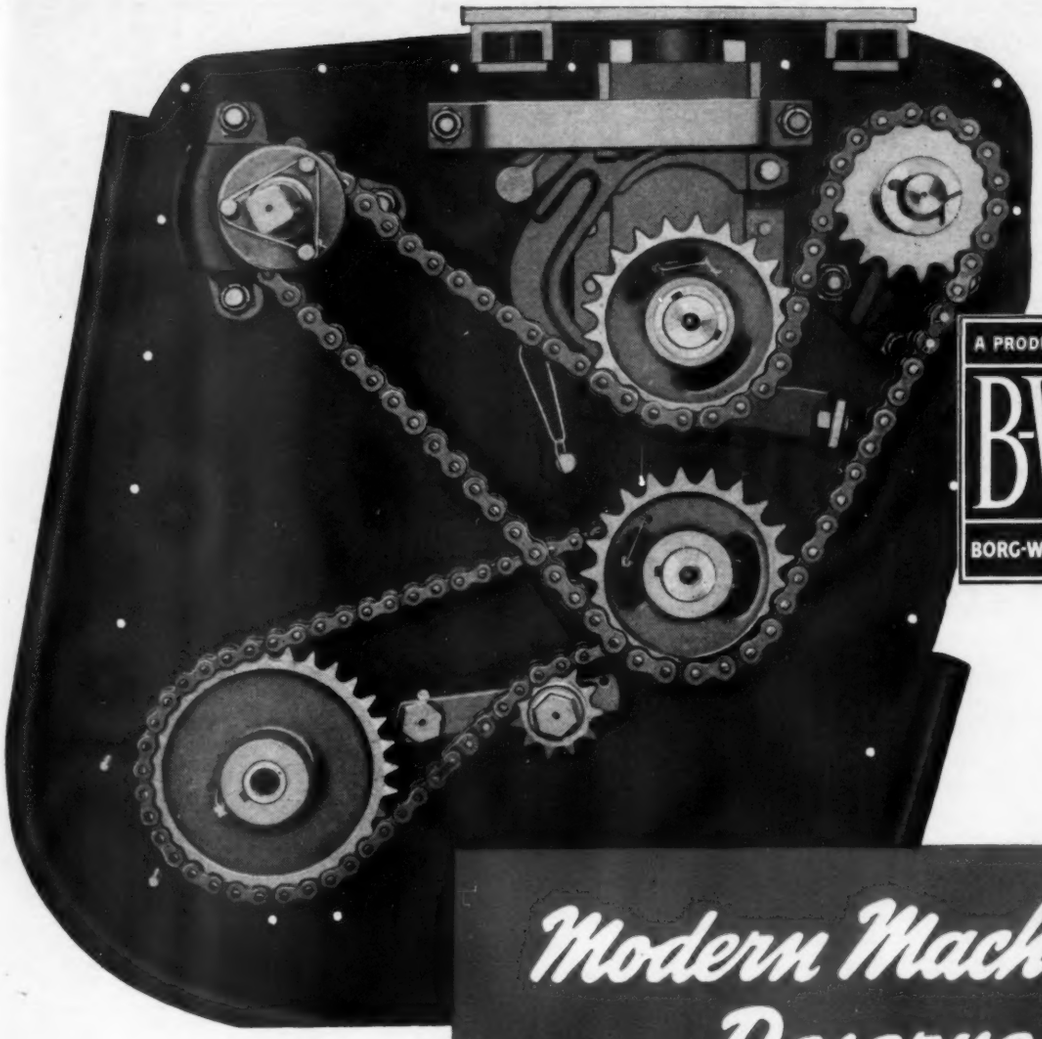
THE RUTHMAN MACHINERY CO.
1809 READING ROAD
CINCINNATI 2, OHIO
The "GUSHER"—A Modern Pump For Modern Machine Tools

Announcing **MEAD MIDGET AIR CLAMPS**

Horizontal and Vertical!

Both models deliver 80 lbs. pressure on a line pressure of 100 lbs. They'll save countless man-hours in assembly operations involving welding, riveting, bolting, etc. *Advantages over mechanical clamps:* 1. Any number can be operated by single master valve. 2. Easily installed in cramped corners. 3. Equal ram pressure at any stroke point. Send for new Mead AIR POWER Catalog, describing our line of Air Clamps, Air Vises, Air Presses, Work Feeders, Valves, Controls, etc.

MEAD SPECIALTIES COMPANY
4114 NORTH KNOX AVENUE
DEPT. MA-46 • CHICAGO 41, ILL.



A PRODUCT OF B-W BORG-WARNER

Modern Machines Deserve Morse Drives...

Modern design makes it possible to "make hay in a day" with John Bean Mfg. Company's "Haymaker." Morse Nos. 50 and 60 Roller Chains in the drive assembly, using teeth not tension, mean positive, efficient, trouble-free operation. MORSE CHAIN COMPANY, ITHACA, N. Y., DETROIT 8, MICHIGAN.

MORSE ROLLER and SILENT CHAINS

SPROCKETS • FLEXIBLE COUPLINGS • CLUTCHES

Steel-Weld FABRICATION

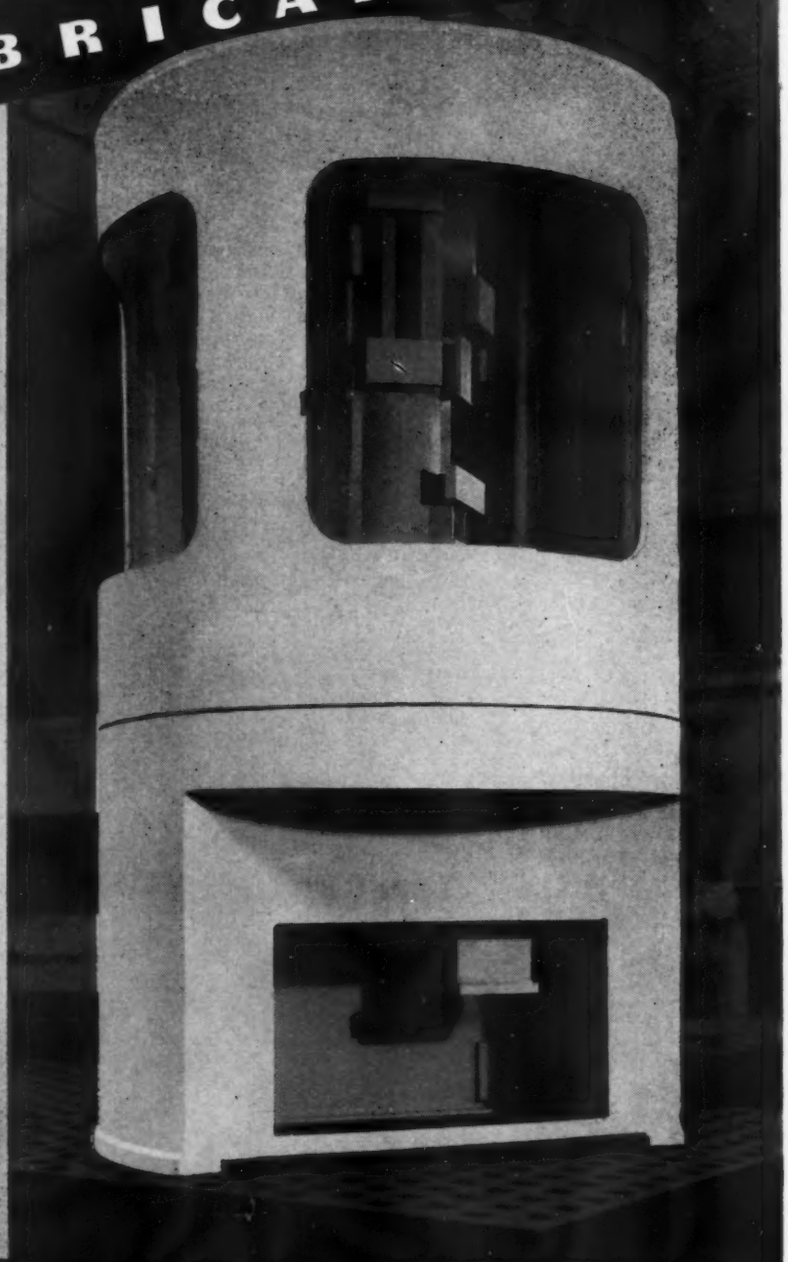
Putting PRECISION into the Art

Uppermost in the minds of Mahon Craftsmen engaged in Steel-Weld Fabrication, are Precision and Finished Appearance . . . their pride of accomplishment manifests itself in every completed weldment leaving the Mahon plant. Mahon design engineers are always available and ready to cooperate with you in redesign or adaptation problems, in order that all the advantages of Steel-Weld Fabrication may be applied to your product.

Address Inquiries to STEEL-WELD DIVISION

THE R. C. MAHON COMPANY

HOME OFFICE AND PLANT, Detroit 11, Mich.
WESTERN SALES DIVISION, Chicago 4, Ill.



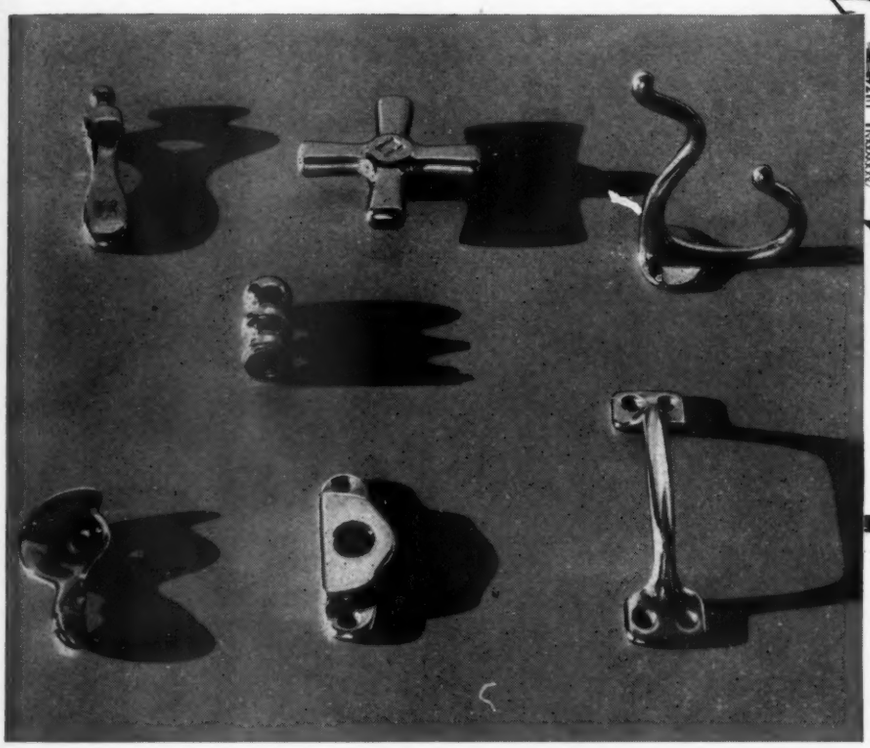
Fabricators of Machine Bases and Frames and Many Other Welded Steel Plate Products

MAHON

Hand Finishing Costs
are High!

ELIMINATE HAND-FINISHING BOTTLENECK!

WITH ROTO-FINISH MECHANICAL FINISHING!



Mechanical Roto-Finish
Costs are Low!

Speed Finishing Time and Cut Costs with ROTO-FINISH

Increased labor costs are making the hand finishing of parts an even greater bottleneck. Many prominent companies are avoiding this problem by Roto-Finishing mechanically, stampings, forgings, die castings, sand castings and machined parts.

1. **Roto-Finish produces a surface comparable to that of hand or wheel finishing on many parts.**
2. **Cuts cost from 35% to 60%.**
3. **Produces a more uniform finish on quantity lots.**
4. **Produces a surface more uniform for plating. Saves plating costs.**

Roto-Finish not only slashes cost and relieves manpower—it is far more accurate. Standards can be set up for finishing that provide the exact surface required on every piece.

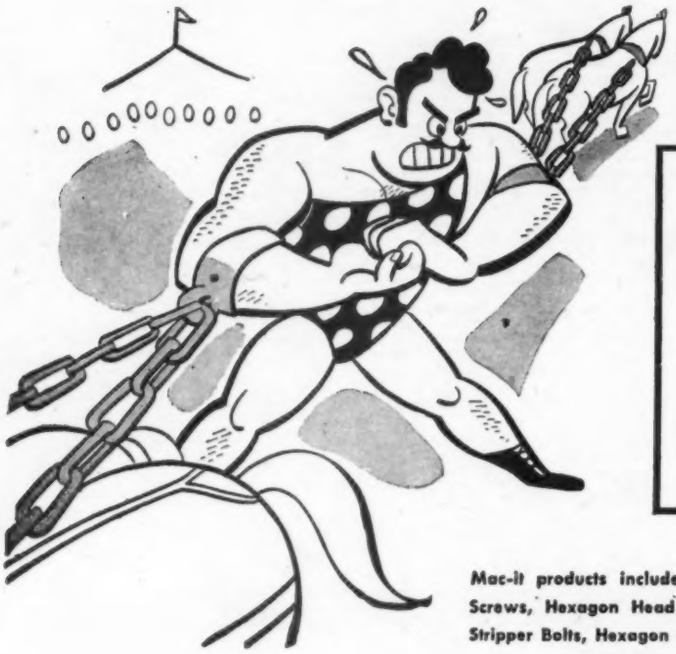
Take advantage of our offer to process your parts and furnish complete information. No obligation. THE STURGIS PRODUCTS CO., 605 Jacobs Street, Sturgis, Michigan.

ROTO FINISH

THE UNIFORM MECHANICAL PROCESS—

FOR GRINDING • DE-BURRING • POLISHING • HONING • COLORING

FOR GREATER *STRENGTH* AND *HOLDING POWER*



...SPECIFY ***Mac-its*** PRONOUNCED "MACK-IT"

Mac-it alloy steel hexagon head cap screws are tested for minimum tensile strength of 145,000 lbs. per square inch and heat-treated for maximum strength and toughness. Particularly useful under conditions of severe vibration.

Mac-it products include Socket Head Cap Screws, Hollow Set Screws, Hexagon Head Cap Screws, Square Head Set Screws, Stripper Bolts, Hexagon Socket Pipe Plugs.

All are made of alloy steel and heat-treated

STRONG, CARLISLE & HAMMOND CO. • *Cleveland 13, O.*

There have been many changes in lubricants. Fiske Brothers' Refining Company has contributed greatly in the development of more efficient and more effective cutting oils. Are you enjoying the benefits of these improvements? Let us compare the results you can get from Fiske cutting oil with the oils you are now using. Fiske Oils are sold only on a "results" basis. Write today for information and literature.

FISKE

Metal Working

LUBRICANTS

FISKE BROTHERS' REFINING COMPANY

NEWARK 5, N. J. *Since 1870* TOLEDO 3, OHIO

Do you have THREADING Problems?

WEDGE *can* ROLL THREADS on Tubing and Hollow Parts

Size—½" dia. to 6"
Wall Thickness—.020 to ¼"
Pitch—From 30 pitch x .020 wall to 4 pitch x .062 to ¼" wall

We can roll threads inside or outside, on steel, brass, copper, aluminum and magnesium tubing of any length—V, acme, round or square threads.

Most of the grief in threading thin wall parts or tubing can be eliminated by the WEDGE process of rolling threads. This exclusive process produces the finest threads obtainable on thin wall parts or tubing. It is NOW possible to use much lighter parts

reducing weight and costs. This process is rapid and economical—can produce up to 1,000 per hour depending upon the size. Will also roll threads efficiently on heavy tubing or parts. *Write WEDGE Engineers about your problem.*

Write for further information.

WEDGE PROTECTORS, INC.

9536 RICHMOND AVE. **CLEVELAND 5, OHIO**

Use WEDGE Chill Rings-Thread Protectors

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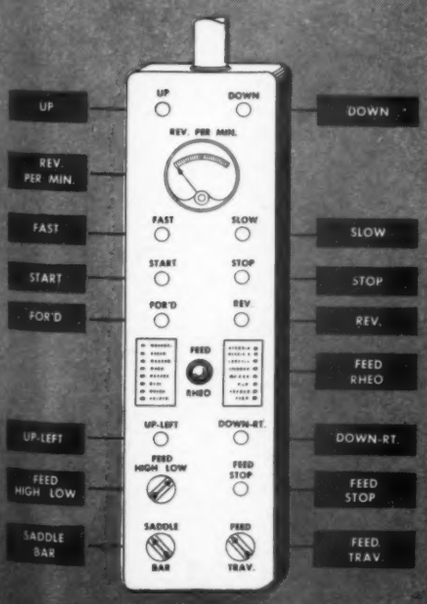

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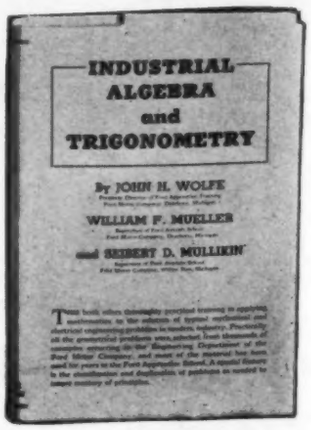

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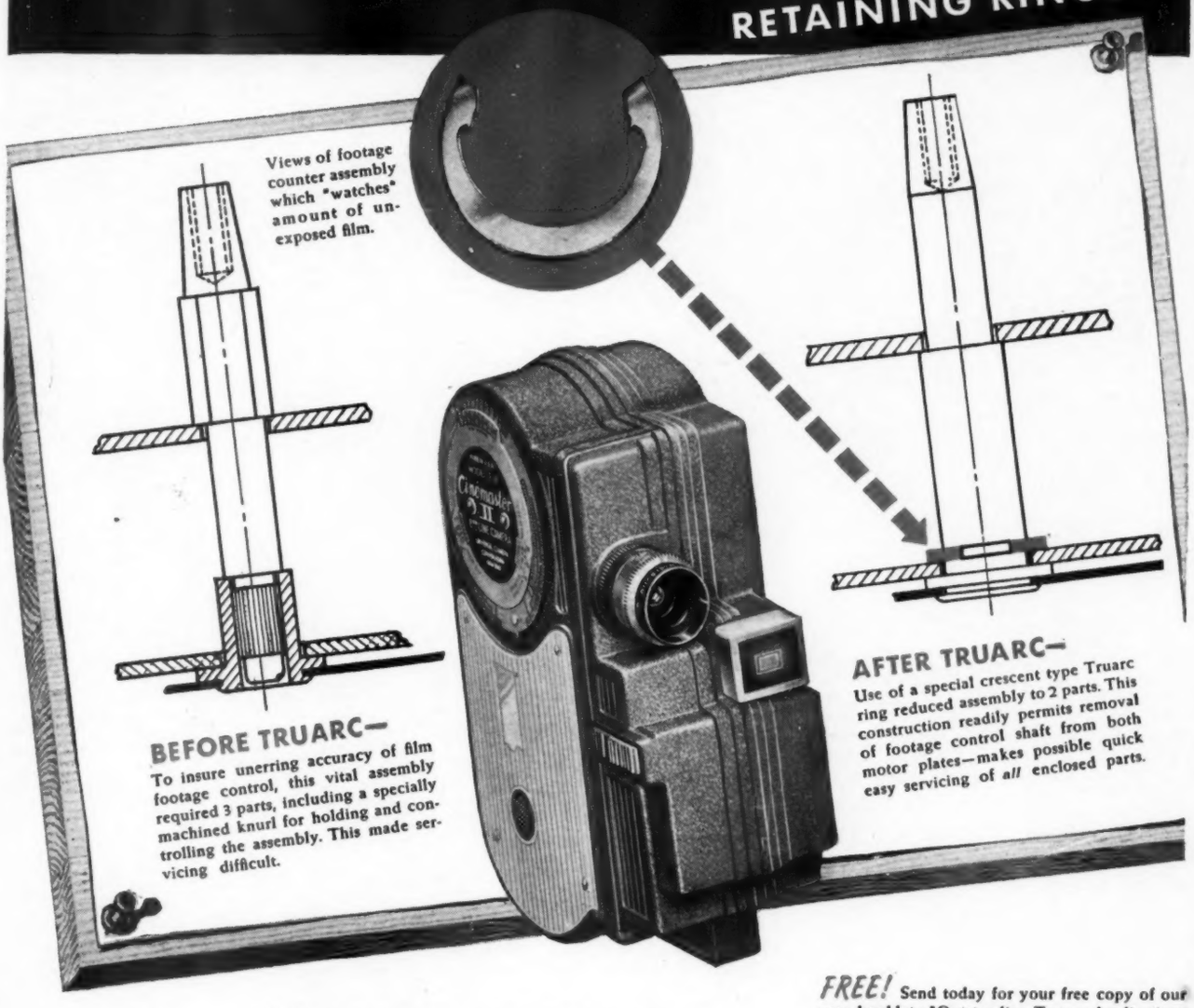
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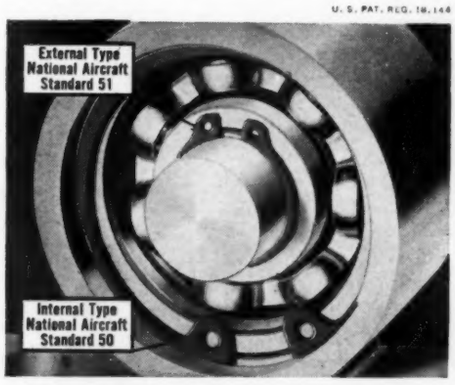

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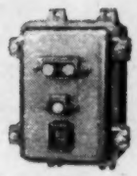

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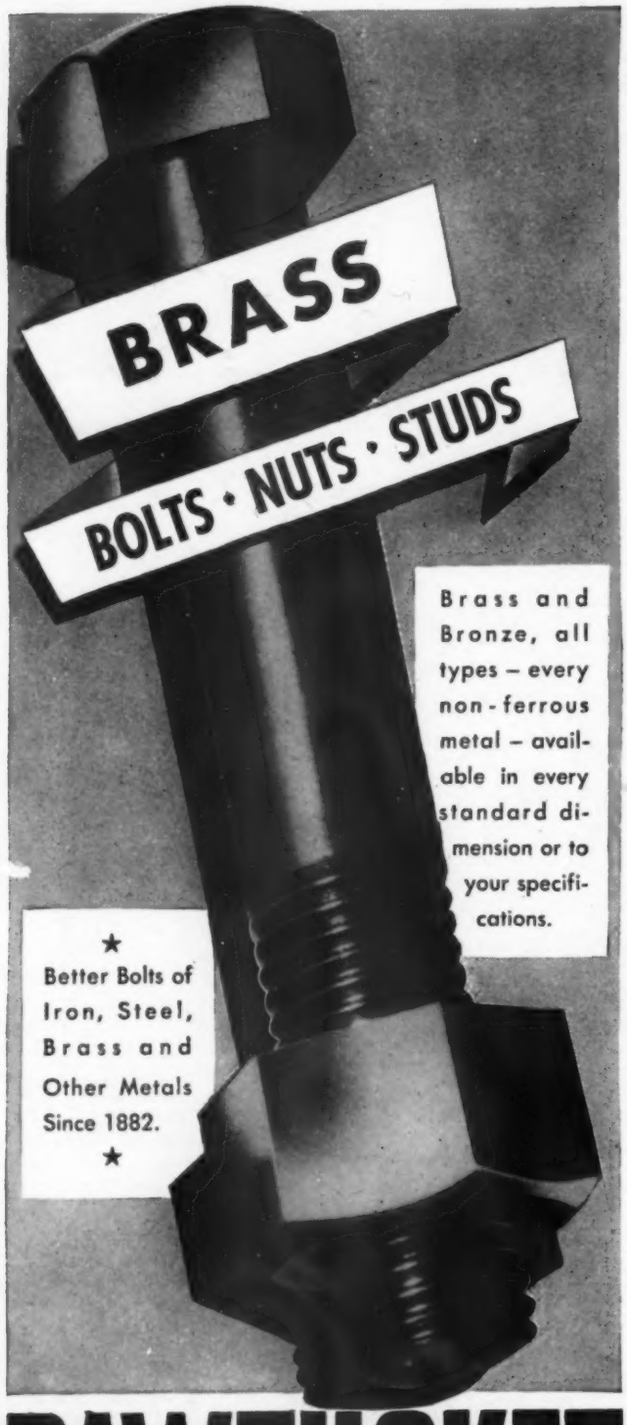

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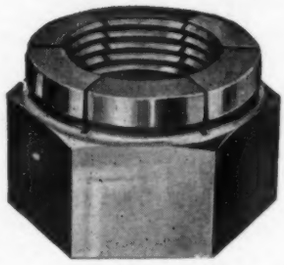

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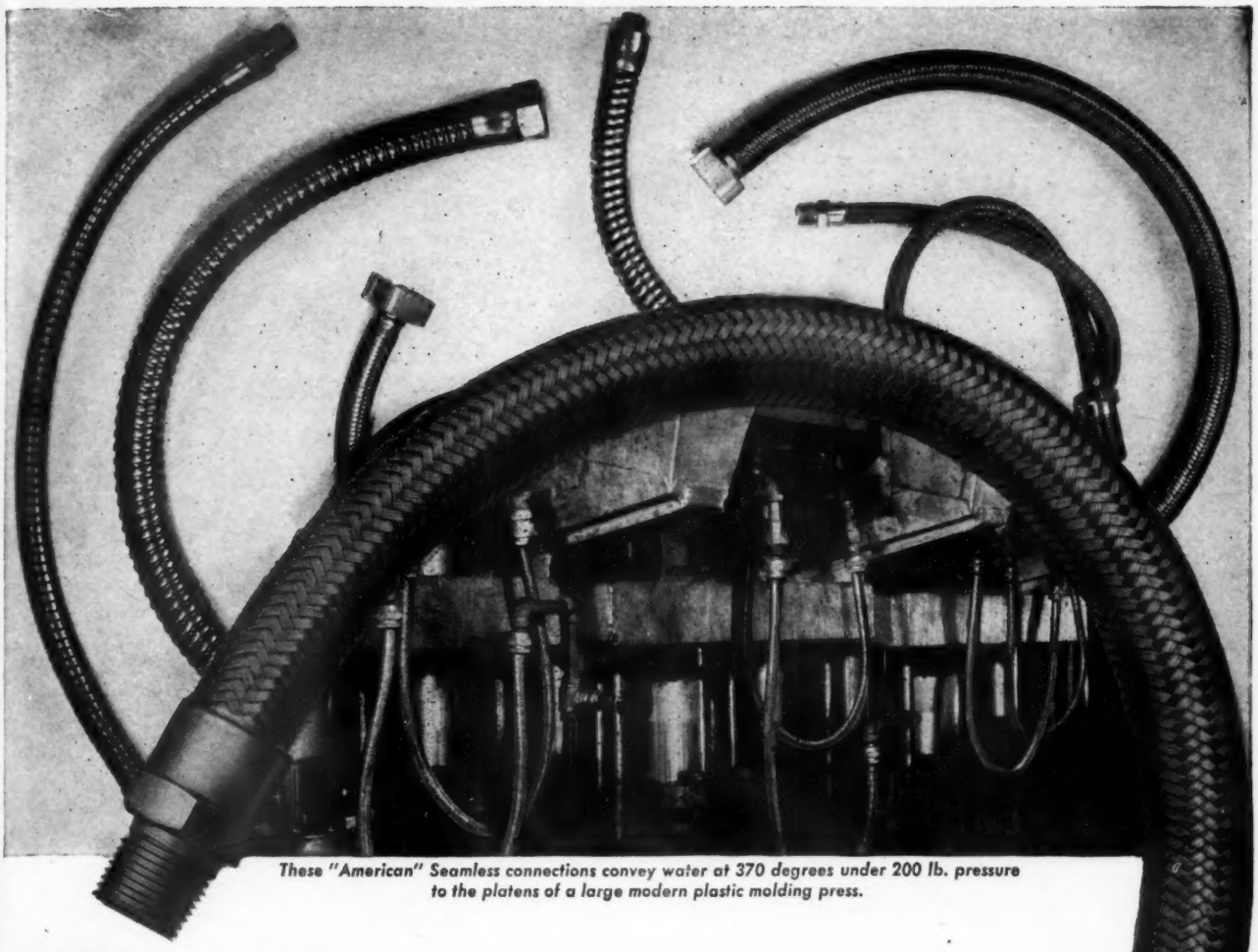

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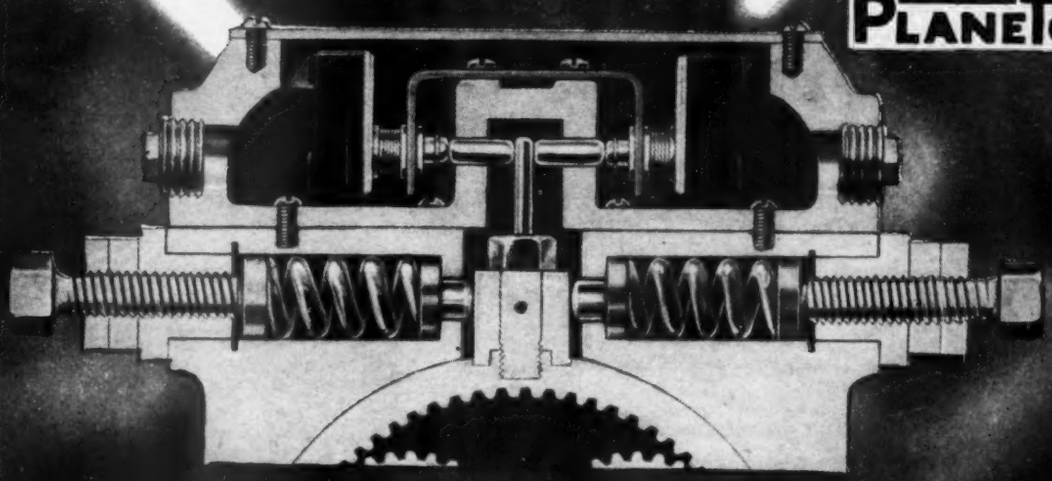

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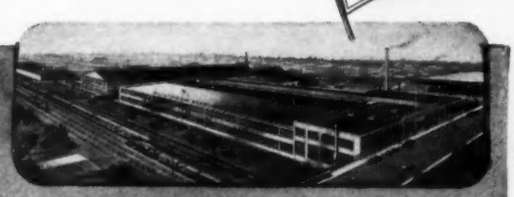

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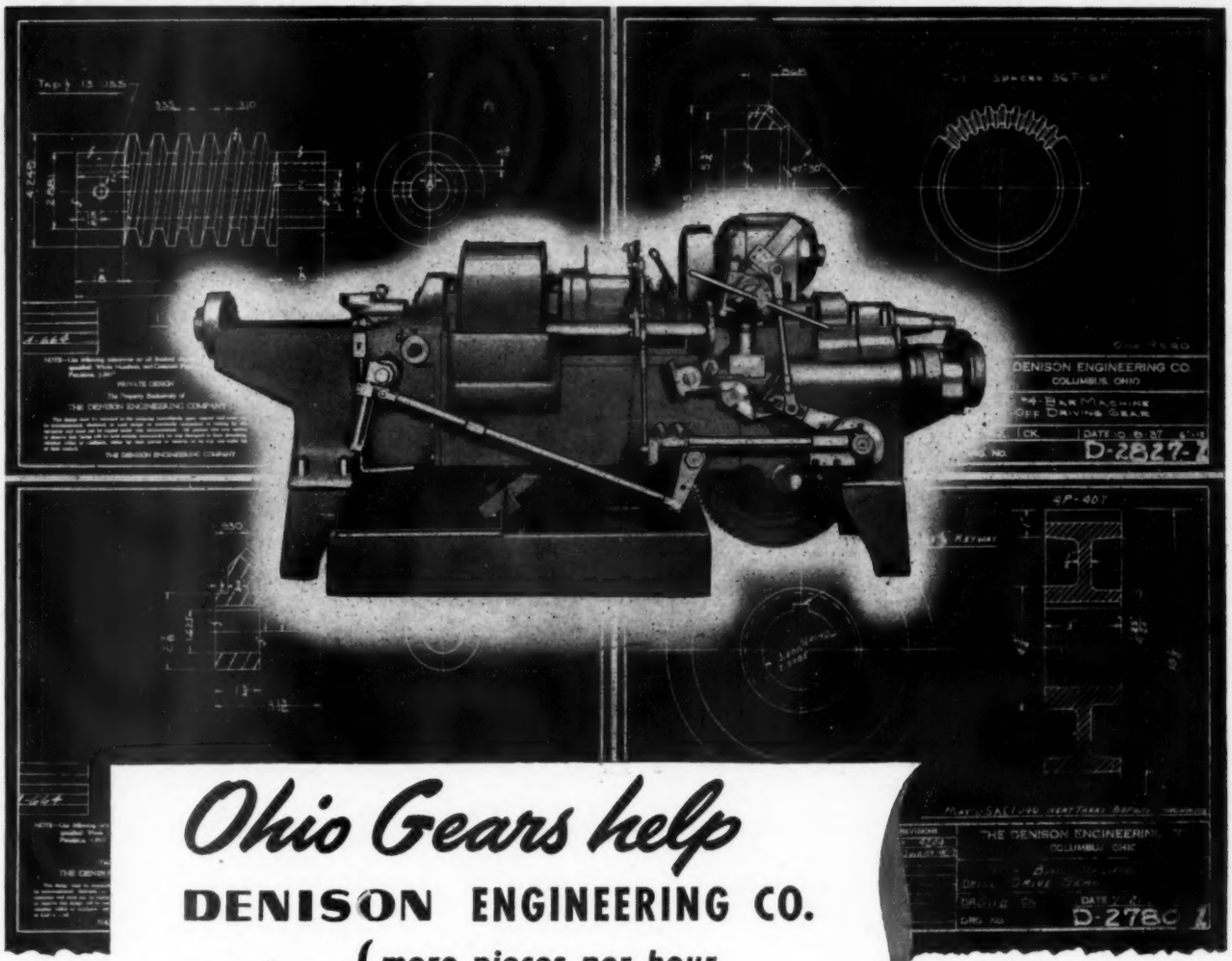

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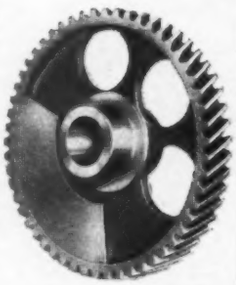

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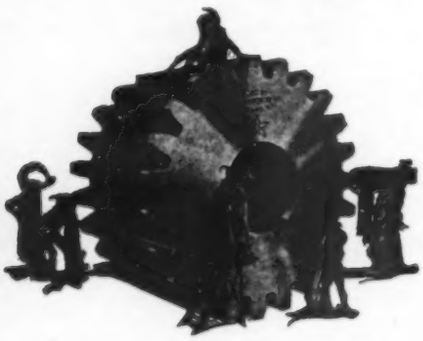

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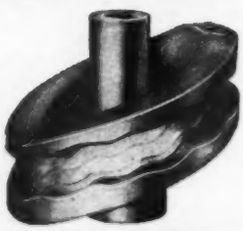

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Here is a mine of ideas for any machinist, in devising methods for handling difficult or unusual jobs. More than this, by showing scores of usable and adaptable ideas for using machines in different ways, the book gives invaluable aid to the shop owner and operator in saving production time when the normal machine for the job is laid up, busy, or otherwise not available, and in profitably increasing the variety of work handled by his shop.

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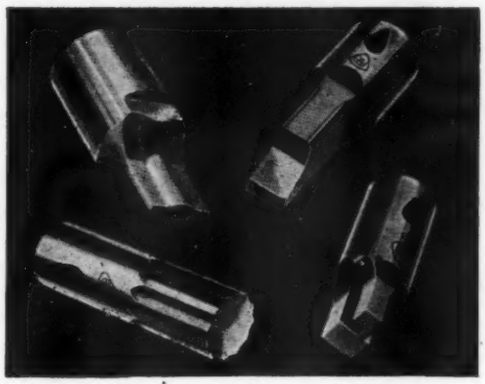

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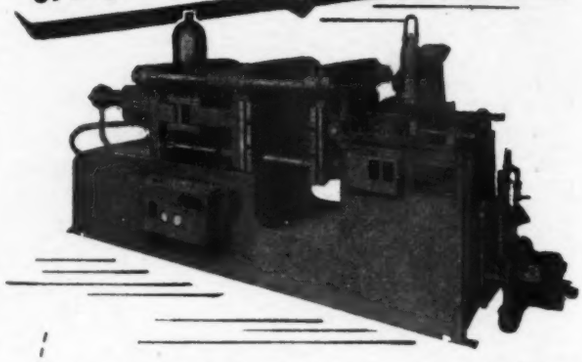

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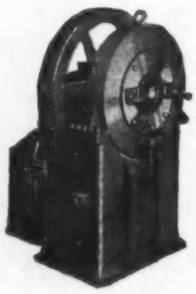

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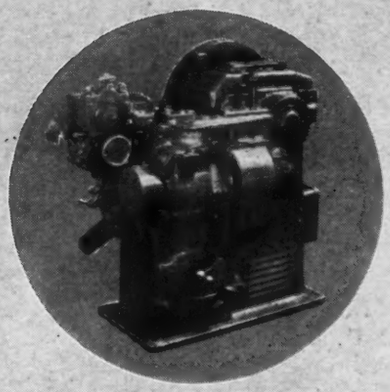

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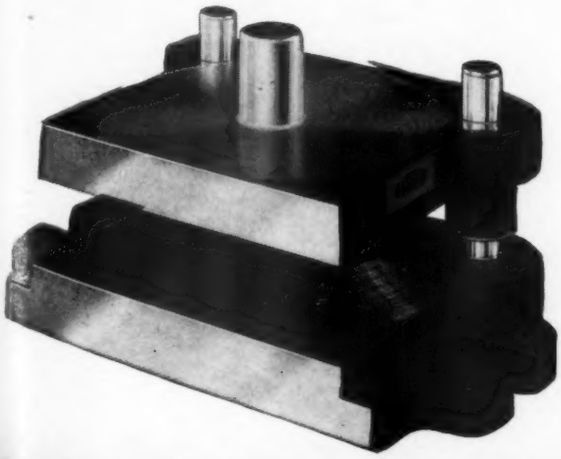

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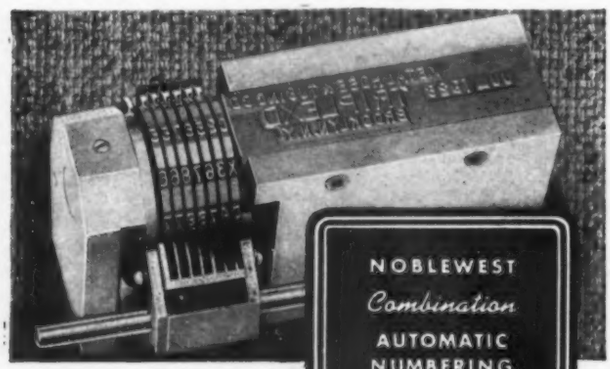

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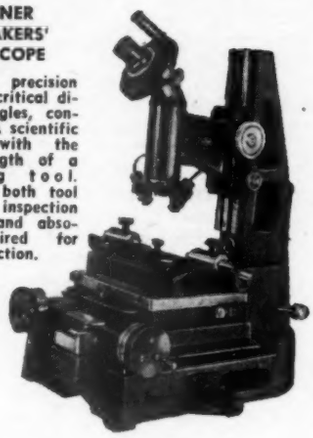

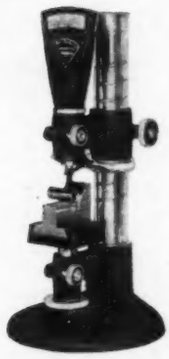

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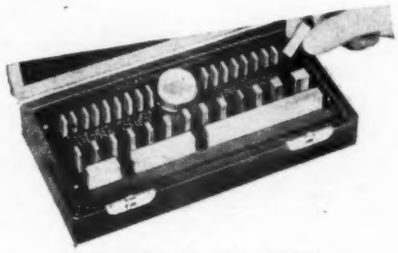

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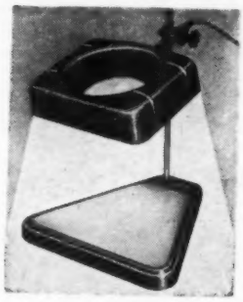

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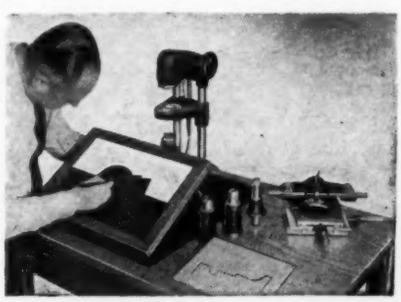

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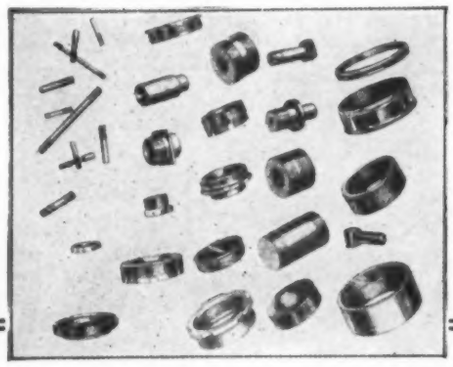

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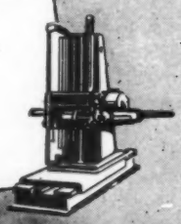

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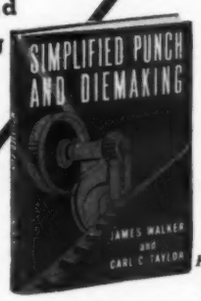

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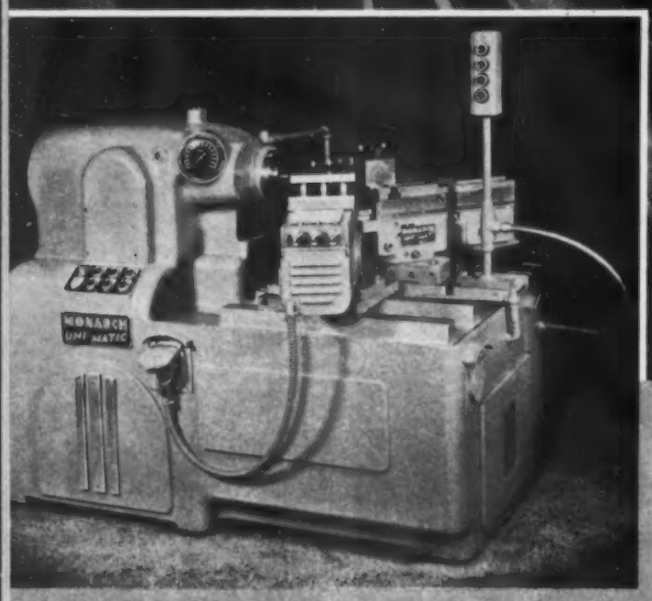
Monarch
TURNING MACHINES

Uni-Matic



An automatic turning machine for chucking and fixture work —combines high production and extreme accuracy on turning, boring and facing operations. Broad range of spindle speeds up to 1000, 2000, 3000 and even 5000 rpm. Completely independent electronically controlled action of each interchangeable Uni-Mat (a motor-driven tool slide) permits universal positioning as well as universal tooling. Feed range ½" to 13" per minute, with rapid traverse of 100" per minute. Suitable for work as small as 1" and as large as 16" diameter.

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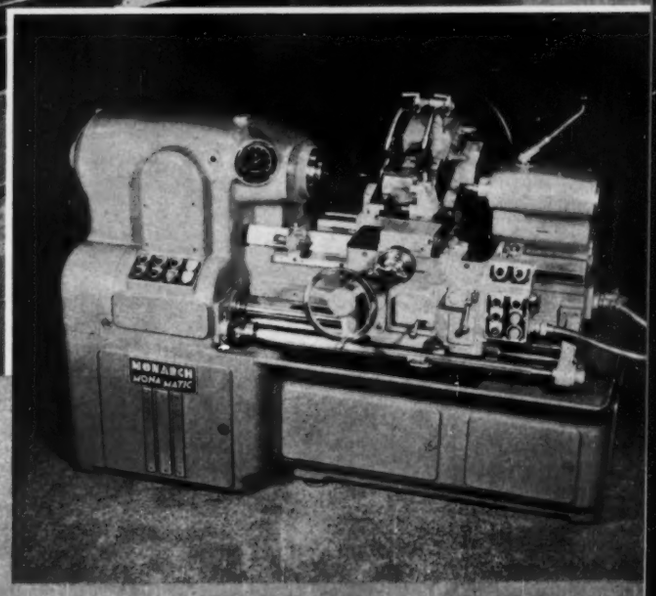

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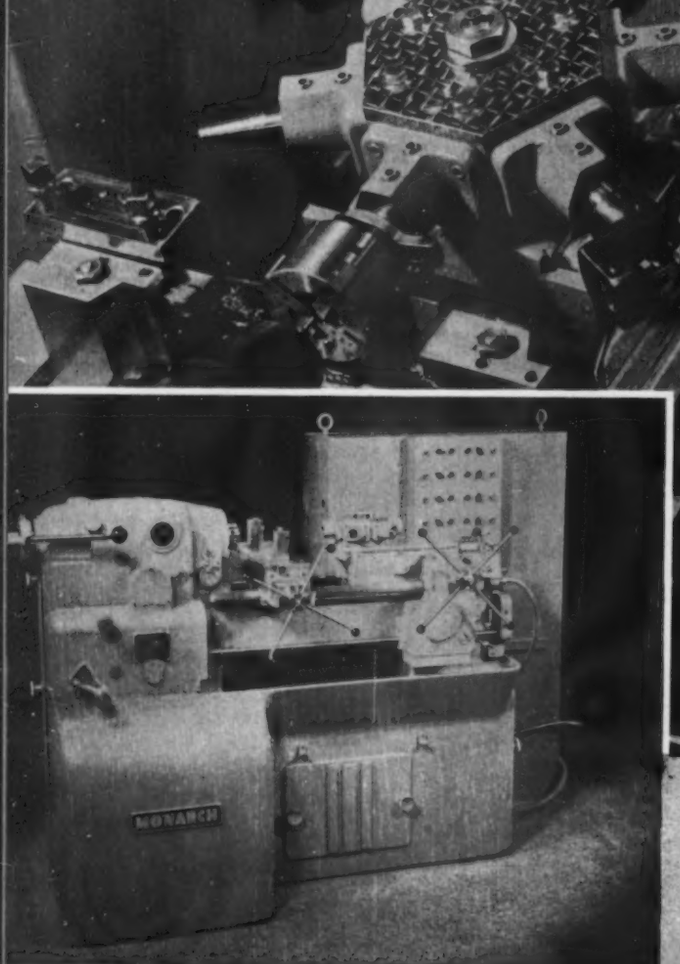
Speed-Matic



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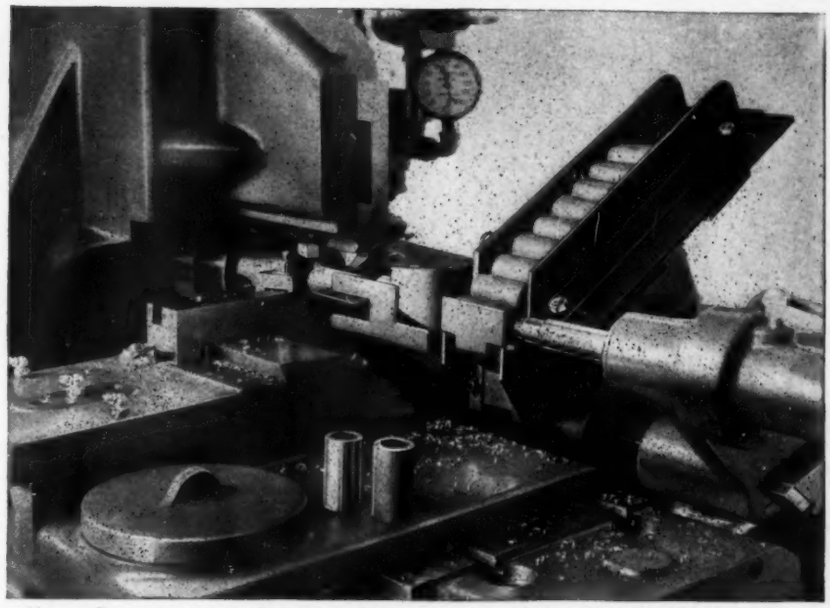
Problem: Turning and facing *both* ends of a variety of bronze bushings on automatically loaded lathe. Bushings to vary in length and diameter, and to come to machine rough cast with hole broached.

Solution: Bushings are loaded onto an expanding arbor by a plunger which picks up the bottom bushing from the inclined chute shown in upper illustration. A movable stop locates the bushing on the arbor and then withdraws to allow tools on the Third Slide (see lower illustration) to face *both* ends of the bushing to length. Simultaneously, the Front carriage tool turns the O D. A stripper kicks the finished bushing off the arbor and into the unloading chute while tools are returning to starting position.

When bushings of another diameter are to be turned, ease and quickness in change-over are provided. The operator merely changes the arbor loading plug, makes a quick adjustment to take care of longitudinal tool travel, and resets the tools. If there is sufficient change in bushing diameter to necessitate a different spindle speed, a change of easily-accessible pick-off pulleys makes this a simple operation. The loader chute is made adjustable to accommodate various bushing lengths and diameters.

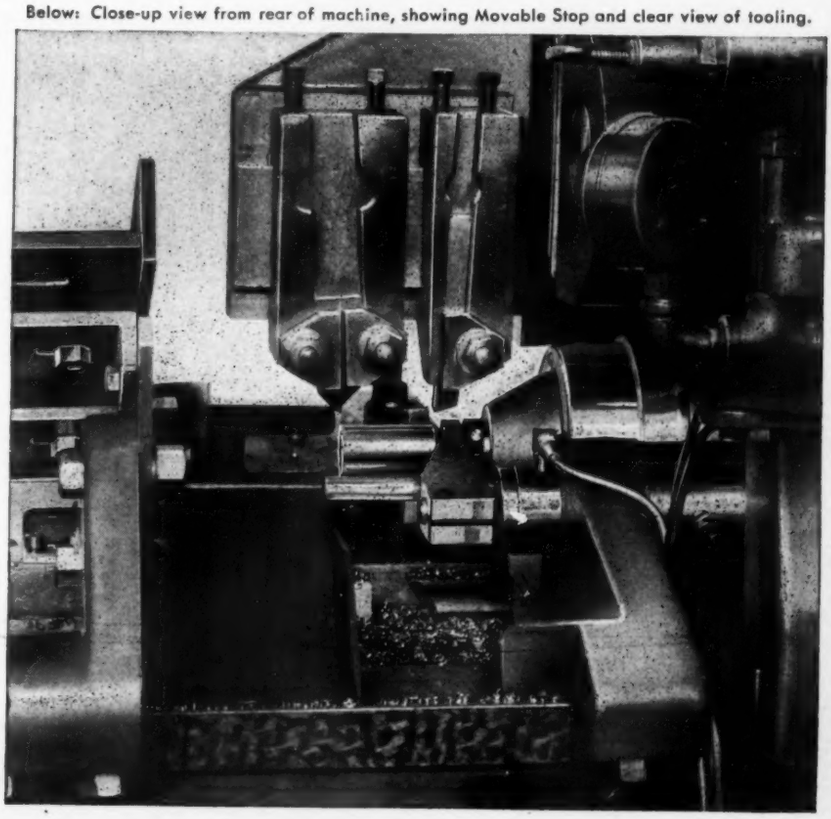
The Lo-swing IMP worked out very well on this job due to the availability of the Third Slide for the facing operations, thus leaving the rear of the machine open for loading and unloading. Tungsten Carbide Tools were used on this job with speeds and feeds set accordingly. Other inherent IMP features, such as rigidity, accuracy at high speeds, and ease of change-over contributed also in large measure to the satisfactory solution of the job.

SENECA FALLS MACHINE CO.
Seneca Falls, N. Y.



Above: Close-up view from front of machine showing Loader Chute and Loading Plunger.

Below: Close-up view from rear of machine, showing Movable Stop and clear view of tooling.

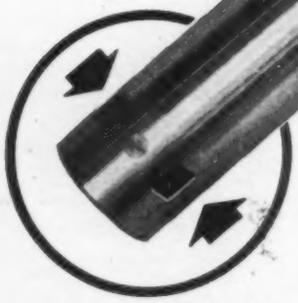


LATHE NEWS from SENECA FALLS

Van Norman Boring Bar

Close-up — rectangular broaching operation on column of boring bar

PRODUCTION INCREASED 937½%



Openings .437" wide by .562" high broached in each column.

VAN NORMAN COMPANY of Springfield, Massachusetts, had a tricky precision problem which they turned over to our engineering staff. Lapointe solved it with special fixtures on a standard broaching machine. We quote from their letter to us: "Previously this job took 1¼ hours and is now performed in 8 minutes. The finished product has achieved the maximum in precision, all due to the experience and knowledge of broaching as demonstrated by your Engineering Department."

THE Lapointe MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U.S.A.

Bring your precision metal removing problems to Lapointe because Lapointe machines are *designed* for increased precision production. Write Dept. 410.

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES

HOLES IN A HURRY!

DUMORE HIGH SPEED BENCH DRILL

HIGH SPEED MOTOR—1/30 HP Universal motor, equipped with self-aligning sleeve bearings, provides speeds from 2,000 to 15,000 R.P.M.

No. 0 JACOBS CHUCK—provides a capacity for drill sizes from No. 60 to No. 30 drills.

LARGE WORKING AREA—Three-inch diameter table permits drilling to center of six-inch circle.

UNUSUAL FLEXIBILITY OF ADJUSTMENT—Movement of work table accurately regulated by adjustable feed stopnuts.

FULL CONTROL OF SPEED—A foot rheostat enables operator to vary speeds according to the operation, with both hands free for work.

SMALL—LIGHT—PORTABLE—Weighs only 15 lbs.... overall height only 14½"... can be easily moved wherever needed.

SOLID, STABLE BASE—Measuring 5" x 8", it insures the stability needed for precision work.

● Conveniently small, compact, and light in weight, Dumore's High Speed Bench Drill performs scores of precision drilling operations at production pace. Its wide range of speed, full control of speed, adjustable features, and precision construction make it ideal for tool shop or production work within its range. The Dumore Co., Tool Division, Dept. TD14, Racine, Wis.

$52.50 (Universal Motor—DC to 60 cycle AC 115 and 230 volt standard)

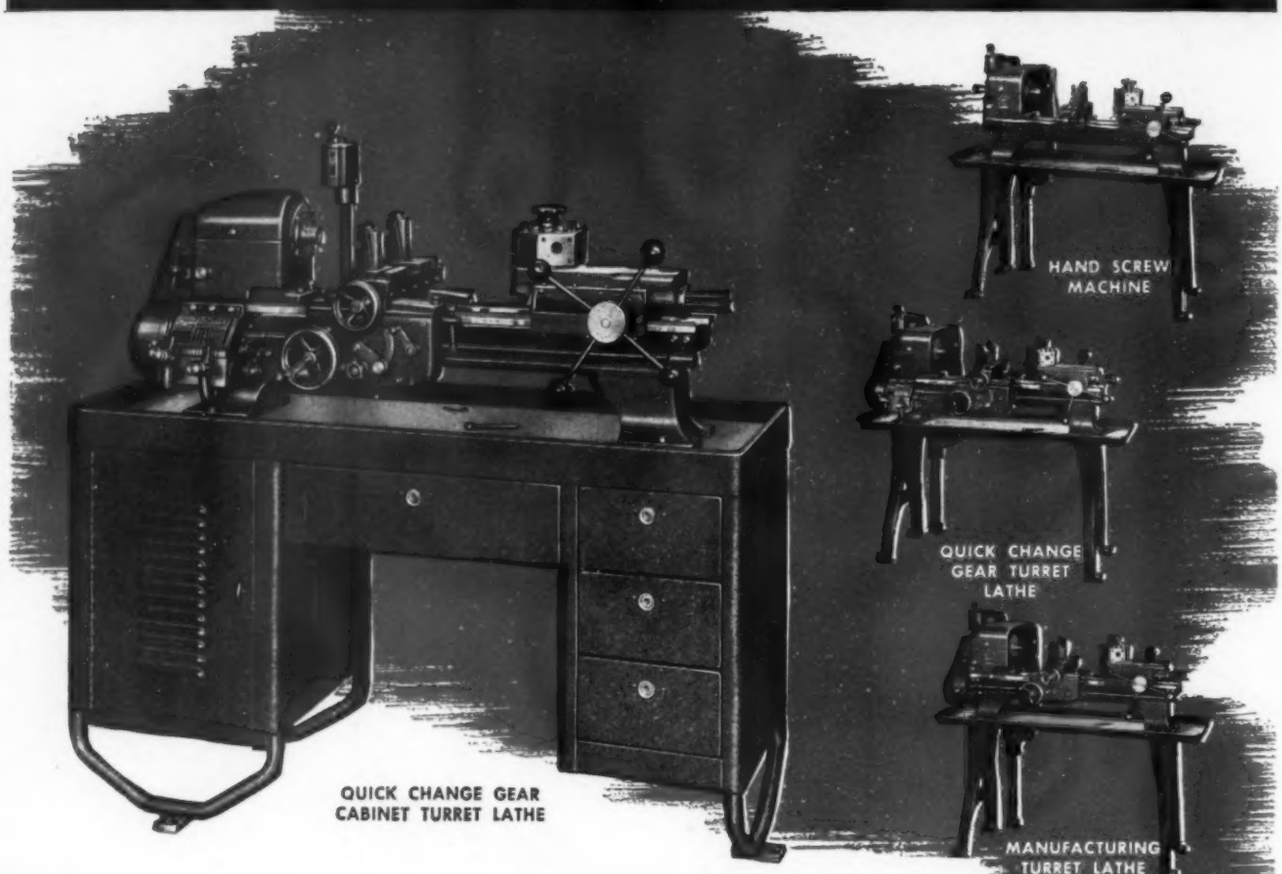
DUMORE
PRECISION TOOLS

WRITE FOR CATALOG 42

Catalog 42 contains full information on the Dumore High Speed Bench Drill and other Dumore precision tools, including tool post grinders and hand grinders. Write for your copy!

SOLD BY AUTHORIZED INDUSTRIAL DISTRIBUTORS IN ALL PRINCIPAL CITIES

Logan A NAME TO REMEMBER WHEN YOU THINK OF BETTER LATHES



LOGAN TURRET LATHES

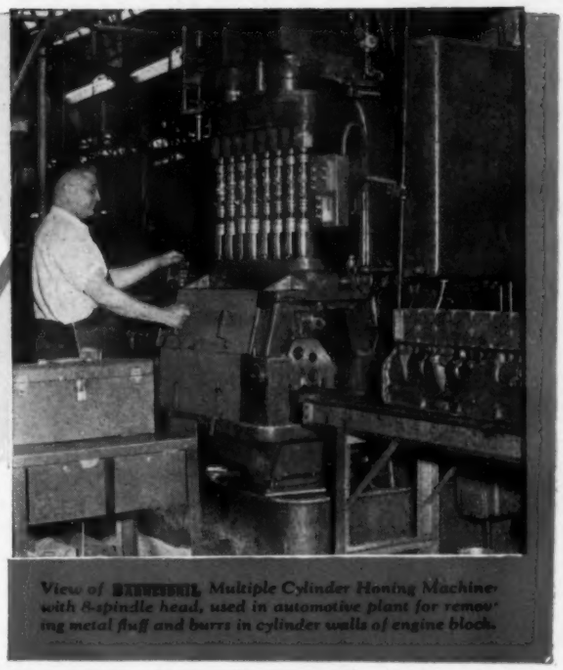
For Speed, Accuracy, Ease and Economy on a Wide Variety of Work

The speed, accuracy and versatility which made Logan Turret Lathes so effective in war production now bring increased efficiency and decreased costs to peacetime operations. Ruggedly built, with heavy hexagonal turrets, these lathes perform smoothly and accurately. They handle a wide variety of operations with the precision essential to fine work. Heavier and more expensive equipment can thus be released for larger work with an increase in both production and efficiency. Quickly and easily set up, Logan Turret Lathes minimize time loss between jobs. As in all Logan Lathes, the sustained accuracy, and dependable, economical operation of these turret lathes results from accurate, rugged construction and Logan advanced design. Spindles, for example, are mounted on special New Departure Ball Bearings which require no adjustment within the full Logan speed range of 30 to 1450 rpm, and which permit the use of high speed carbide cutting tools to full advantage. And the heavy beds, with oversize ribs and balanced sections, have two V-ways and two flat ways precision ground to within .0005" of parallelism. Similarly high standards of accuracy are maintained in building and assembling every part of these lathes. That is why ordering your Logan Turret Lathes now is sound preparation for production jobs ahead. Ask your Logan Lathe dealer, or write direct for full information.

SPECIFICATIONS COMMON TO ALL LOGAN TURRET LATHES . . . Swing over bed, 10½" . . . bed length, 43" . . . size of hole through spindle, 25/32" . . . distance across turret head flats, 5¼" . . . 6 positions with adjustable stops . . . self indexing . . . maximum stroke of turret, 4¼" . . . spindle nose diameter and threads per inch, 1½"- 8 . . . 12 spindle speeds, 30 to 1450 rpm . . . motor, ½ hp, 1750 rpm . . . ball bearing spindle mounting . . . drum type reversing motor switch and cord . . . precision ground ways, 2 V-ways, 2 flat ways. 1-1

LOGAN ENGINEERING CO. CHICAGO 30, ILLINOIS

Here's How to REMOVE METAL FLUFF and BURRS in CYLINDER BORES



View of BARNESDRIL Multiple Cylinder Honing Machine with 8-spindle head, used in automotive plant for removing metal fluff and burrs in cylinder walls of engine block.

IMPROVED, FINER AND MORE ACCURATE FINISH ACCOMPLISHED WITH BARNESDRIL HONING MACHINES

To assure "correct lubrication, a reduction in friction, and no scoring during the break-in period," this automotive plant uses the BARNESDRIL Multiple Spindle Honing Machine for removing all metal fluff and burrs in their engine blocks. The honing operation, following finish boring, produces a smooth, scuff-free cylinder wall finish. Approximately .0003" is removed from the apex of the spiral groove on the cylinder wall during the honing operation of the twenty-one reciprocating strokes made consecutively in the eight cylinders of the engine block.

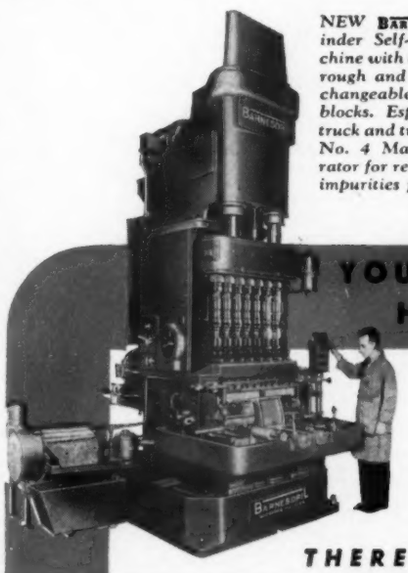
The danger of scoring or scratching the finished bore is further minimized by the addition of a BARNESDRIL No. 4 Automatic-Magnetic Coolant Separator to the Honer, which removes all metal swarf from the coolant. (See view at lower left.)

CLOSER TOLERANCES, GREATER ACCURACY AND IMPROVED PRODUCTS THROUGH HONING . . .

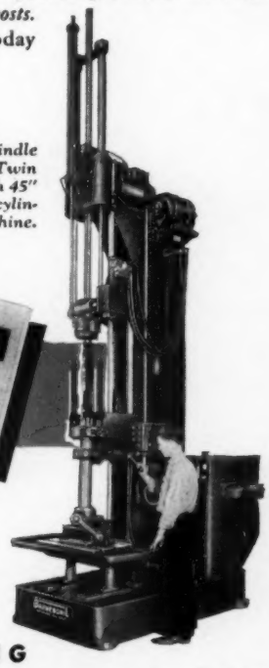
Honing is accomplished by simultaneous rotations and reciprocations of the hone within the bores to be finished. Proper honing can give you any desired surface finish; uniform, final dimensional size accuracy; final geometric accuracy; and faster, more economical stock removal.

Greater accuracy, closer tolerances and mirror smoothness are assured in final finishing operations with BARNESDRIL Honing Machines, available in vertical, horizontal and angular types, and in many different sizes, for both internal and external honing. These machines handle internal honing jobs up to 42 inches in diameter and 75 feet or longer, if required. Finish accuracy of .0005" or less is easily obtained. In high speed production, surface finishes of 2 to 3 micro inches are constantly maintained.

Pioneers in the development, design and construction of honing machines, BARNESDRIL engineers can recommend the proper honing machine best suited for your part design and production requirements. Their recommendations will give you *finer finish, greater accuracy, improved products, increased production,* and *lower finishing costs.* Send complete "part" details today . . . there is no obligation.



NEW BARNESDRIL *No. 320 Multiple Cylinder Self-Oiling Hydraulic Honing Machine with 8-spindle auxiliary head for both rough and finish honing operations. Interchangeable heads handle 4, 6 or 8 cylinder blocks. Especially suited for automobile, truck and tractor sleeve housing.* BARNESDRIL *No. 4 Magnetic-Automatic Coolant Separator for removing all metal swarf and other impurities from coolant is included.*



BARNESDRIL *No. 307 Single Spindle Hydraulically Reciprocated Twin Cylinder Honing Machine, with 45" spindle travel. Landing gear cylinders are finish honed on this machine.*

YOU NEED THIS HONING DATA BOOK . . .

which describes the honing process and its production advantages, together with BARNESDRIL Honing Machine features and specifications. A free copy will be sent on request. Ask for Book No. A -121.

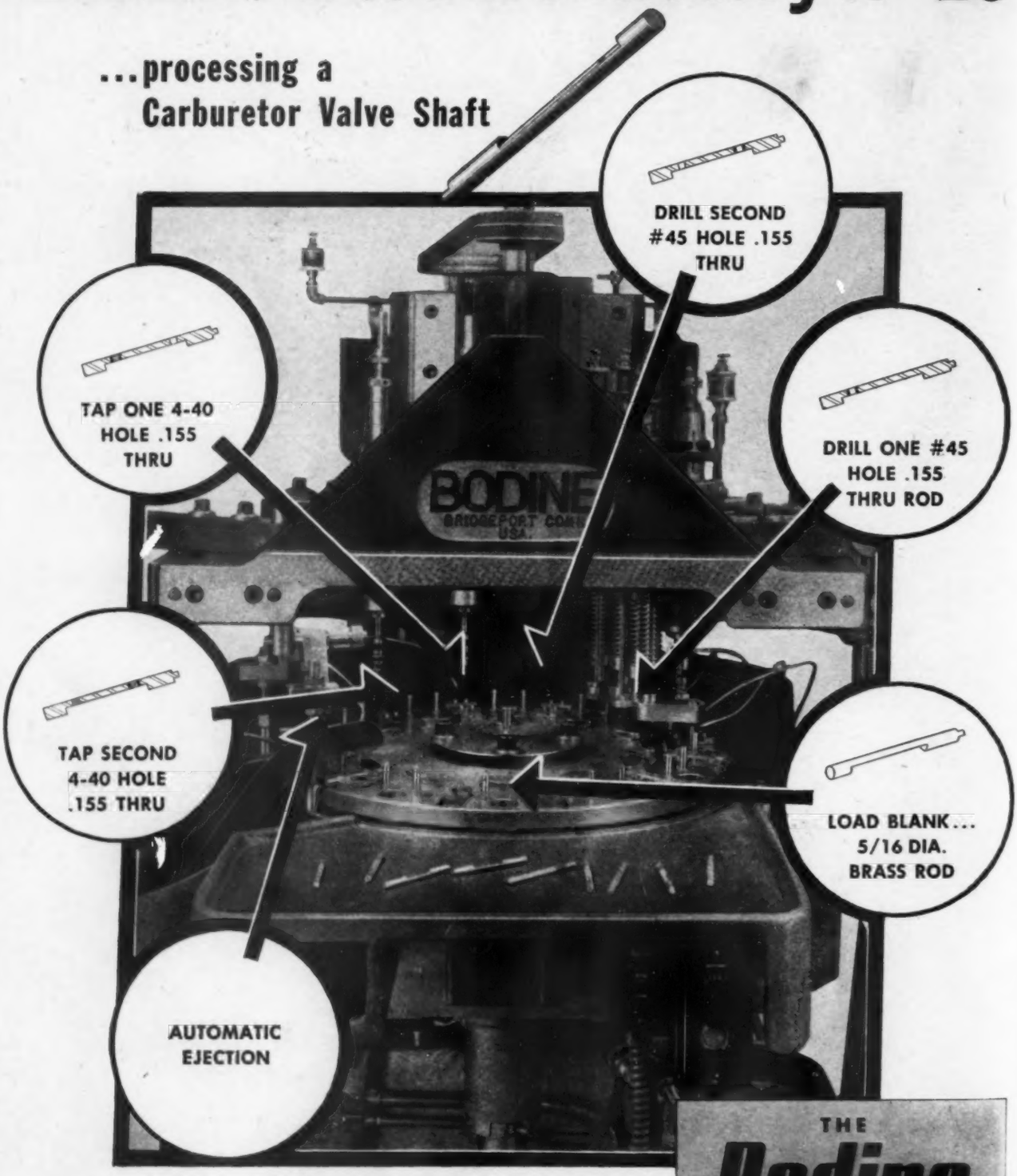
THERE IS NO SUBSTITUTE FOR HONING

Barnes Drill Co.

830 CHESTNUT STREET
ROCKFORD, ILLINOIS, U. S. A.

Bodine..Case History Nº 16

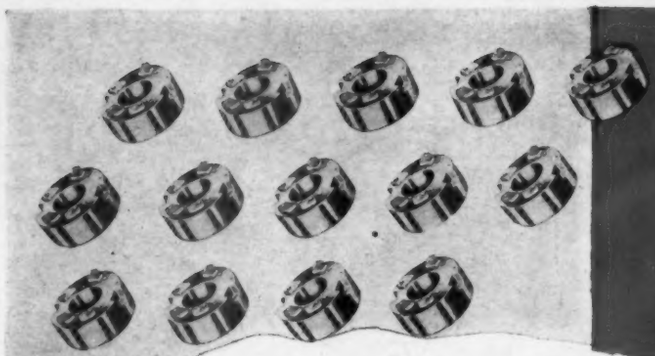
...processing a Carburetor Valve Shaft


DRILL SECOND #45 HOLE .155 THRU
TAP ONE 4-40 HOLE .155 THRU
DRILL ONE #45 HOLE .155 THRU ROD
TAP SECOND 4-40 HOLE .155 THRU
LOAD BLANK... 5/16 DIA. BRASS ROD
AUTOMATIC EJECTION
BODINE
BRIDGEPORT CONN. USA

• Production . . . 1250 pieces per 50 minute hour, one completed piece per stroke of the Bodine Dial type Drilling and Tapping Machine. Interesting Bulletin on request.

THE **Bodine** CORPORATION
BRIDGEPORT CONNECTICUT

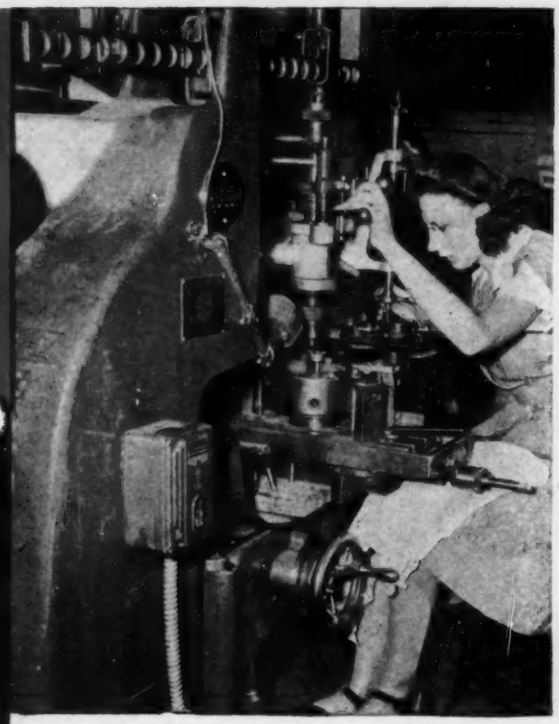
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

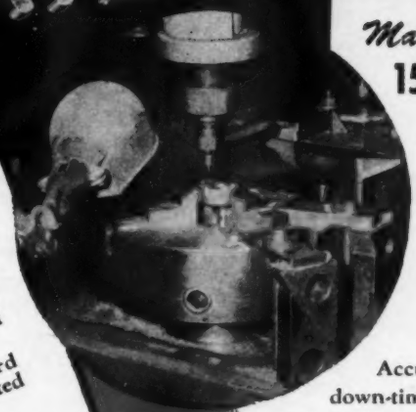


Injection Molds Completed

5 TIMES FASTER ON A GORTON

3-DIMENSIONAL PANTOGRAPH





JOB FACTS

NAME OF PART—Injection Mold.
MATERIAL—Tool Steel (oil hardening).
MACHINE—Gorton 3-Dimensional Engraver Model 3-L.
ATTACHMENTS—Standard three jaw chuck mounted on table.
TOOLS USED—Special Cutters ranging from .035" dia. to .340" dia.
TEMPLATE USED—2 to 1 frill shape master.
FORMER TIME—15 hours per mold.
PRESENT TIME—3 hours per mold.
ACCURACIES—All dimensions held to .0005".

Machining Time Reduced from 15 Hours to 3 Hours per Mold

ACCURACIES HELD TO .0005"

Here's an example of the type of performance you'll get on a Gorton 3-Dimensional Pantograph Engraving Machine. This large manufacturer experienced difficulty in the production of these injection molds. Time required was 15 hours per mold. Accuracies were hard to maintain. Machine down-time was excessive. Man hours were wasted.

In an effort to remedy these, the job was tooled-up on a Gorton 3-Dimensional Engraving Machine. First an enlarged master template was cut. Then, using this as a pattern, the desired molds were turned out at the correct size at the rate of one every 3 hours. The other disturbing factors were also remedied. Dimensions were held to .0005" due to Gorton pantographic reduction method. Down-time was drastically reduced. Man hours were conserved.

QUALITY WORK ON A PRODUCTION BASIS

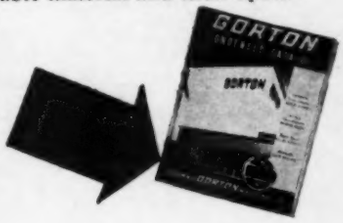
Gorton Pantograph Machines are noted for the consistency with which they turn out quality work on a production basis. They are available in both 2 and 3-dimensional models to handle many types of reproduction assignments. They can be used with high efficiency on any machinable material and their operation is extremely simple.

HOW TO PREDETERMINE THE RESULTS OF TOOLING YOUR JOB ON A GORTON PANTOGRAPH

Send detail prints or a work sample to Gorton Engineering Service at the address below. Tooling information and production estimates will be furnished promptly—no charge or obligation. You can then predetermine the possible improvement over your present methods.

FREE ADDITIONAL INFORMATION

Get the details on Gorton Pantographs and other Gorton machines by sending today for your copy of Bulletin No. 1655.



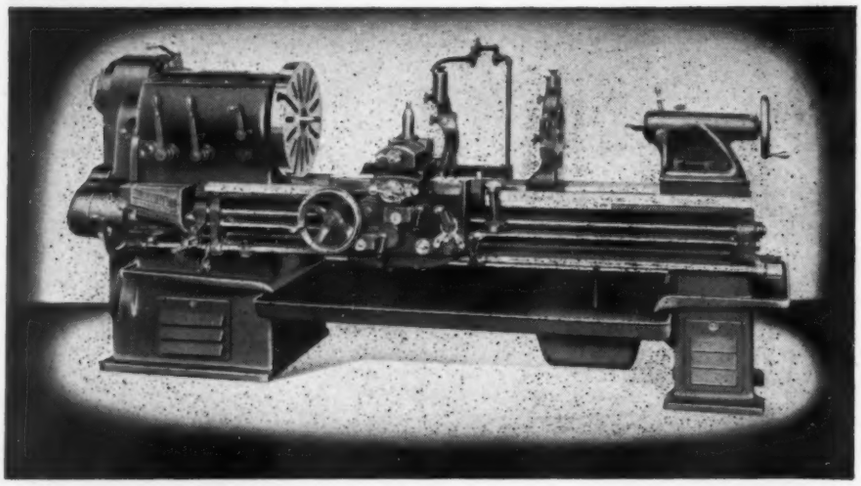
GEORGE GORTON MACHINE CO.

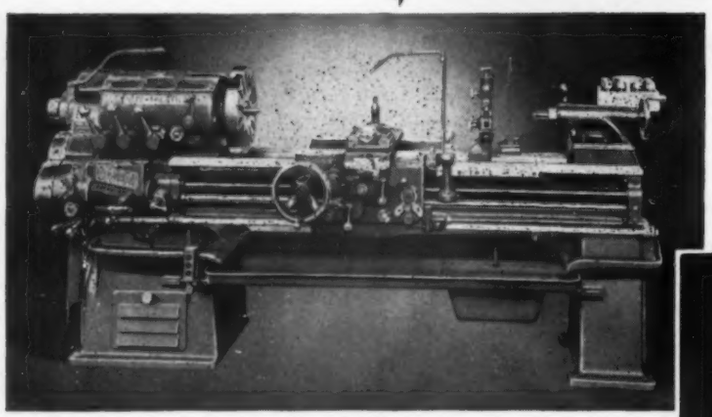
1504 RACINE STREET, RACINE, WISCONSIN, U.S.A.

LATHES ...for PROMPT DELIVERY!

(Approximately 2 to 4 weeks shipment. We have available standard motors in 220/440 volt, 3 phase, 60 cycle)

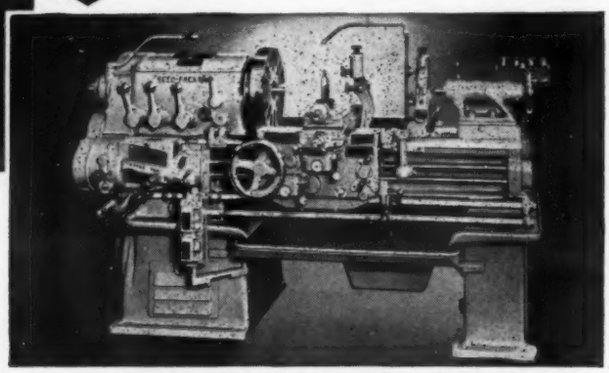
Reed-Prentice Sliding Gear Head 20" Engine Lathe has many features, resulting in precision, economy and operating efficiency. Rugged construction, modern design, unexcelled workmanship and finish — all contribute to its reputation for machine tool supremacy.





Reed-Prentice Sliding Gear Head 16" Lathe — available in Engine and Toolroom models.

Reed-Prentice Sliding Gear Head 14" Lathe — available in Engine and Toolroom models.



REPLACE WORN EQUIPMENT . . .

How much of your lathe equipment is old in service — beyond its years? Now is the time to retire overworked, war-worn engine and toolroom lathes and replace with new, efficient REED-PRENTICE Sliding Gear Head equipment. 14", 16" and 20" Engine and 14" and 16" Toolroom Lathes available with standard equipment and accessories described in our circulars — write for them without delay!

★ ★ ★ ★ ★

MACHINE TOOLS

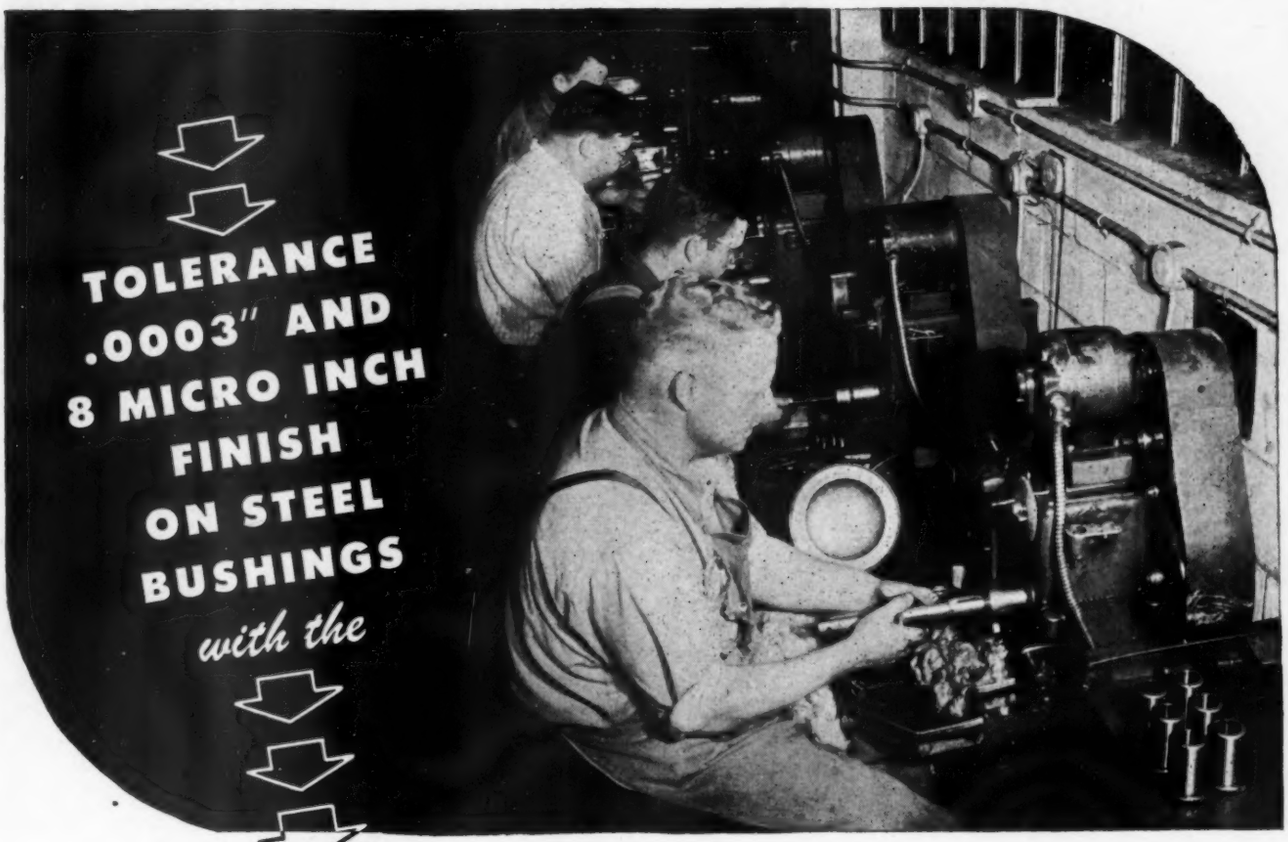
REED-PRENTICE CORP.

WORCESTER MASS., U.S.A.

★ ★ ★ ★ ★ ★ ★ ★ ★

NEW YORK OFFICE: 75 West St., New York 6, N. Y.

CLEVELAND OFFICE: 1213 W. 3rd St., Cleveland 13, Ohio



TOLERANCE .0003" AND 8 MICRO INCH FINISH ON STEEL BUSHINGS *with the*

SUNNEN *Precision* HONING MACHINE

...at Universal Engineering Co., Frankenmuth, Michigan

The use of the Sunnen Precision Honing Machine on steel bushings at Universal Engineering Company is one of many hundreds where it is producing extremely accurate holes — and very smooth finishes on a production basis.

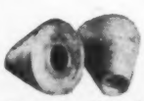
Users of the Sunnen Precision Honing Machine have found it practical, low in cost, easy to operate, quickly and easily installed and easy to set up. It corrects errors of out-of-roundness and taper — corrects wave effect or rainbow condition — maintains alignment between two holes.

The more recent models of this machine (shown at left) have a base assembly that houses a coolant pump. This pumping unit provides a steady flow of honing oil — which increases stone and mandrel life and increases the accuracy of the finished part.

Do you have an internal sizing or finishing problem that demands accuracy to as low as .0001" tolerance for size — and that also demands an absolutely straight hole? On any job from .120" to 2.625" in diameter, the Sunnen Precision Honing Machine may be the ideal solution.

Find out how you, too, can get these advantages that will profitably give you more accurate finishes. Write today for free literature — or ask a Sunnen engineer to show you how this equipment can be used in your plant.

Typical Jobs



Cones for Wheel Balancing Machine "Accurately align hones two interrupted surfaces."

Bearing. A very small part. 2 micro-inch finish necessary.

Aircraft Valve Guide. Valve tappet roller pin hole honed to 6 micro-inch finish.

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

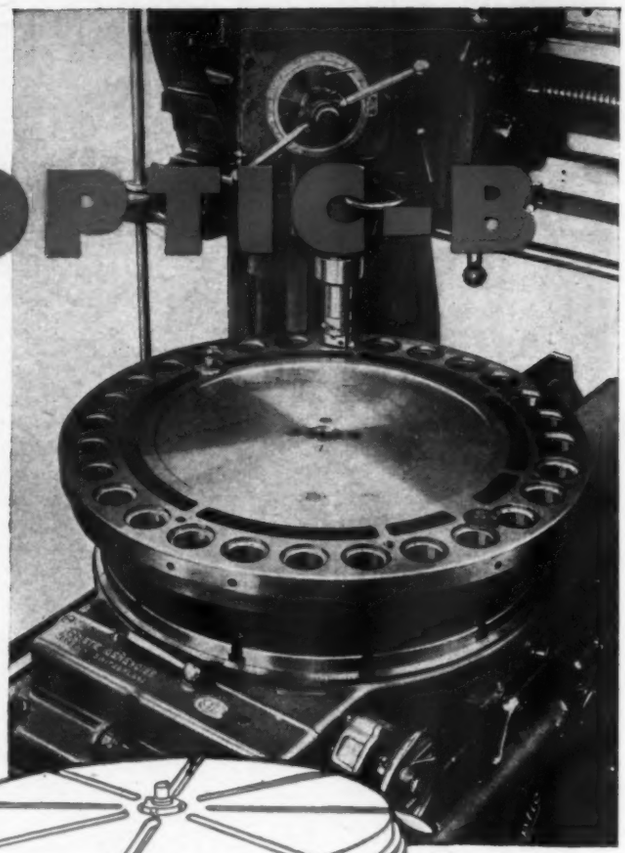
Hydraulic Two-Way Control Valve. Hole is honed to eliminate leakage.

SUNNEN PRODUCTS CO.
7941 Manchester Avenue
St. Louis 17, Missouri
Canadian Factory: Chatham, Ontario

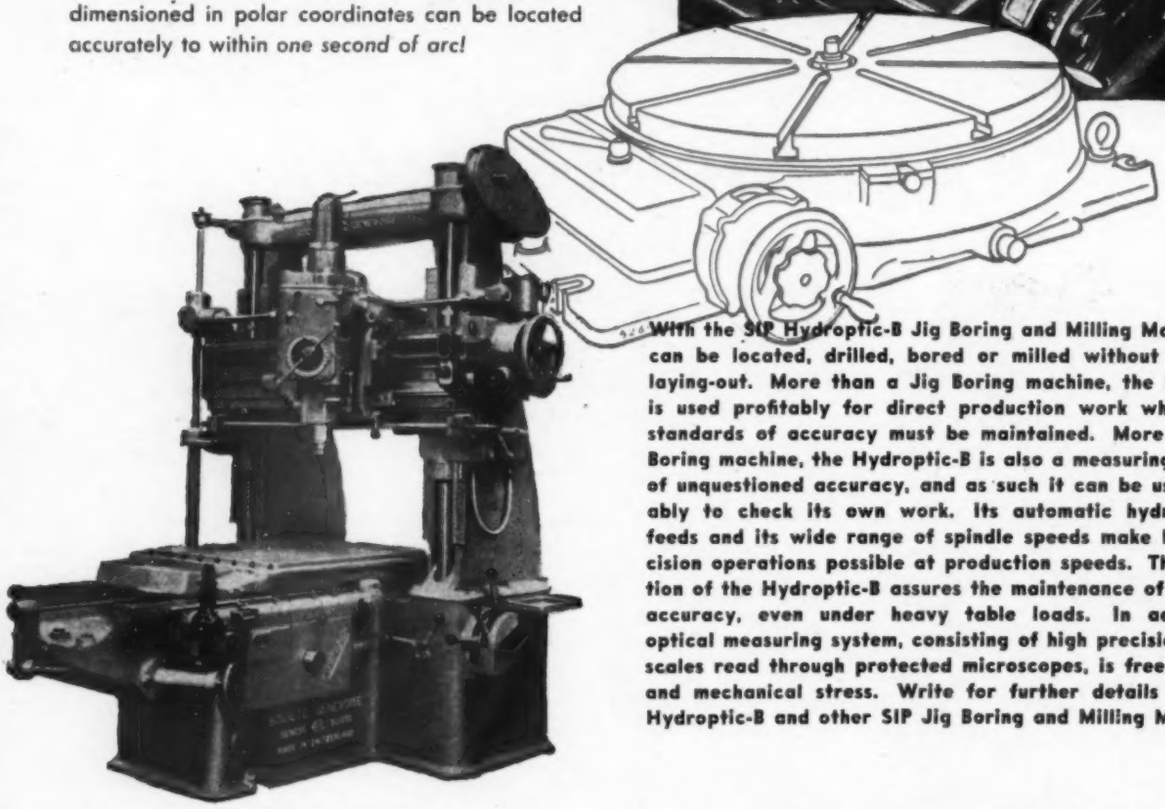
LOCATING AND BORING 28 PRECISION HOLES WITHIN 1 SEC. OF ARC ON THE

SIP HYDROPTIC-B

-no preliminary laying out! -no jigs or fixtures!



All 28 holes on the part shown at the right were bored at one setting on the SIP Hydroptic-B . . . without jigs and without preliminary laying out! The unique optical setting feature of the SIP Hydroptic-B Jig Boring and Milling Machine permits laying out in rectangular coordinates to within 0.0002" limits of accuracy of setting of table and spindle. And, with the circular dividing table, work dimensioned in polar coordinates can be located accurately to within *one second of arc!*



With the SIP Hydroptic-B Jig Boring and Milling Machine, work can be located, drilled, bored or milled without preliminary laying-out. More than a Jig Boring machine, the Hydroptic-B is used profitably for direct production work where highest standards of accuracy must be maintained. More than a Jig Boring machine, the Hydroptic-B is also a measuring instrument of unquestioned accuracy, and as such it can be used dependably to check its own work. Its automatic hydraulic table feeds and its wide range of spindle speeds make highest precision operations possible at production speeds. The construction of the Hydroptic-B assures the maintenance of superlative accuracy, even under heavy table loads. In addition, the optical measuring system, consisting of high precision standard scales read through protected microscopes, is free from wear and mechanical stress. Write for further details of the SIP Hydroptic-B and other SIP Jig Boring and Milling Machines.

RANGE OF TABLE SIZES

No. 2C	18" x 10¾"
No. 3K	21½" x 15"
No. 4G	27½" x 23⅝"
No. 5G	43⅜" x 32"
Hydroptic-B	39½" x 32"

We also represent in the United States other world-famous Swiss High Precision Equipment: Andre Bechler —Maag Gear Wheel Co.—Mikron—Safag—Studer—Sallaz—Schaublin—Lienhard—Billeter

HIGH PRECISION MACHINE TOOLS AND MEASURING INSTRUMENTS

COSA CORPORATION

COSA

CHRYSLER BUILDING
New York 17, New York

Watch them "On the Job"

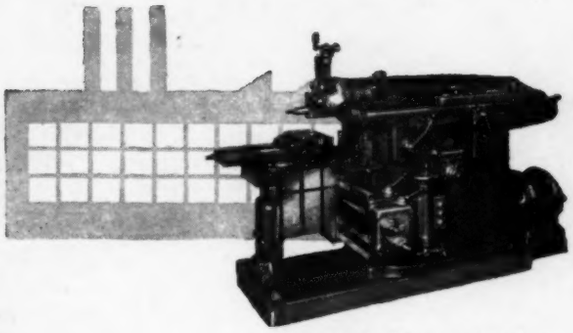
You'll Give These Machines

Top Rating

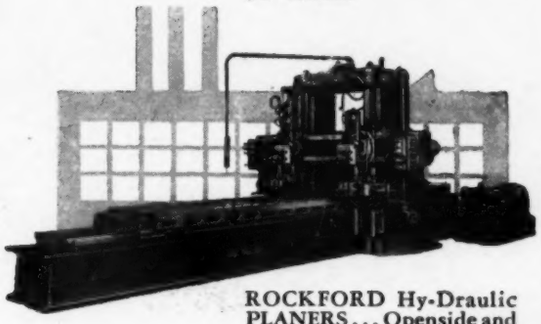
Making set-up work and operation easier results not only in faster work, but better work. These are two advantages that Rockford Hy-Draulic Machines provide. Operator fatigue, often the cause of slow work as well as spoiled work, is cut to a minimum.

If you'll watch these machines "on the job" and check specifications, you'll give them top rating. Unique in their field, Rockford Hy-Draulic Machines offer exclusive advantages that result directly from hydraulic drives and hydraulic feeds. Any cutting speed or feed as well as any cutting stroke length within the range of the machine is quickly and exactly obtained. Efficient, smooth cutting strokes result from hydraulic pressure that maintains an established cutting speed no matter how work resistances may vary. Stroke reversals are made instantaneously and without shock. Accuracy in operation is provided by Rockford design and high standards of construction.

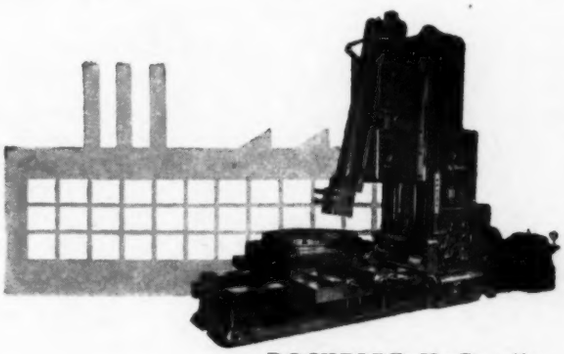
Complete information on Rockford Hy-Draulic Shapers, Planers, Slotters, and Shaper-Planers may be the beginning of better, lower-cost machining in your shop or plant. We invite your inquiry . . . ask for Catalog 1134.



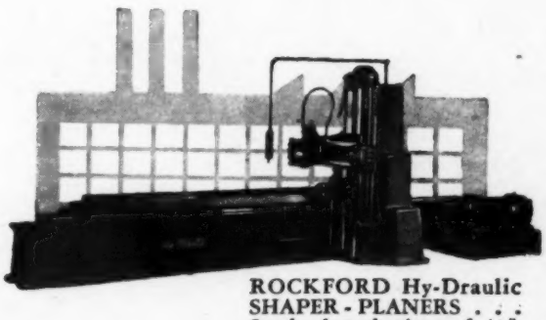
ROCKFORD Hy-Draulic SHAPERS . . . Ram type — 12", 16", 20", 24", and 28" stroke . . . Openside type — 36" stroke.



ROCKFORD Hy-Draulic PLANERS . . . Openside and Double-Housing. Four sizes, each available in maximum stroke lengths of 10, 12, 14, 16, 18 or 20 feet.



ROCKFORD Hy-Draulic SLOTTERS . . . 12", 20" and 36" stroke.



ROCKFORD Hy-Draulic SHAPER - PLANERS . . . Stroke length sizes of 42", 66", 90", 120" and 144".

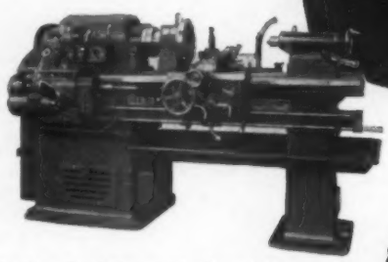
4601

Hy-Draulic

ROCKFORD MACHINE TOOL CO.

ROCKFORD, ILLINOIS

Enduring Accuracy...



Hendey Tool Room Lathe with Sub-Headstock for cutting Long Leads.

for Better Productivity

Whether a machine tool will remain precise for years is determined primarily by its manufacturer. Hendey Tool Room Lathes are *designed to be precise—carefully built to remain precise.*

Hendey Tool Room Lathes will produce accurately for years. The lathe bed is a close-grain alloy casting that is highly resistant to wear. The standard commercial lead screw is accurate to ±.001" per foot of lead. The carriage is scientifically designed to rigidly support maximum tool stresses. The carriage ways are lubricated automatically. Plus these advantages, the Hendey Tool Room Lathe is a fast producer. The geared headstock has 18 speeds—a Lo-Range of 10-652 r.p.m., a Hi-Range of 19-1000 r.p.m. The controls are simple and conveniently located for operator comfort.

If you want faster, more accurate production in the years to come, it will pay you to send for the Hendey Catalog.

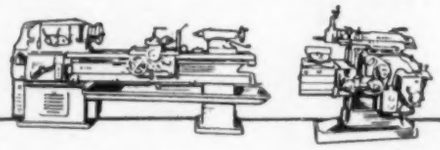
The Hendey Machine Company

Hendey

Main Office and Plant — Torrington, Connecticut

Branch Offices — New York, Chicago, Boston, Detroit, and Rochester

Representatives in — Phila., Cleveland, Los Angeles, Pittsburgh, San Francisco



TOOL ROOM LATHES
12"-14"-16"-18"-20"-24"

SHAPERS
12"-16"-20"

EVERY FIXTURE THE OPERATOR WANTS

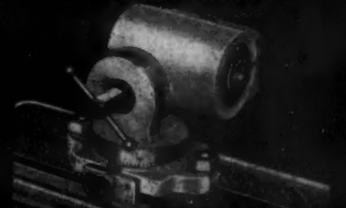
B640 HIGH SPEED GRINDING ATTACHMENT

B643 MOTOR DRIVEN WORK HEAD

B685 RADIAL GRINDING FIXTURE

B642 LARGE SENSITIVE WORK HEAD

B647 TAP GRINDING FIXTURE



A642 SMALL SENSITIVE WORK HEAD

A645 TILTING TABLE ATTACHMENT

B670 SPIRAL HOB AND CUTTER GRINDING FIXTURE

Knock-Out Engineers have made available more time-tested grinder fixtures than has any other manufacturer. If it can be done—it can be done more easily and economically on a K-O Grinder.

Model B600 Single Speed Universal Tool Grinder.

Write Knock-Out at Aberdeen for booklet No. 27-46.

SEE YOUR DISTRIBUTOR

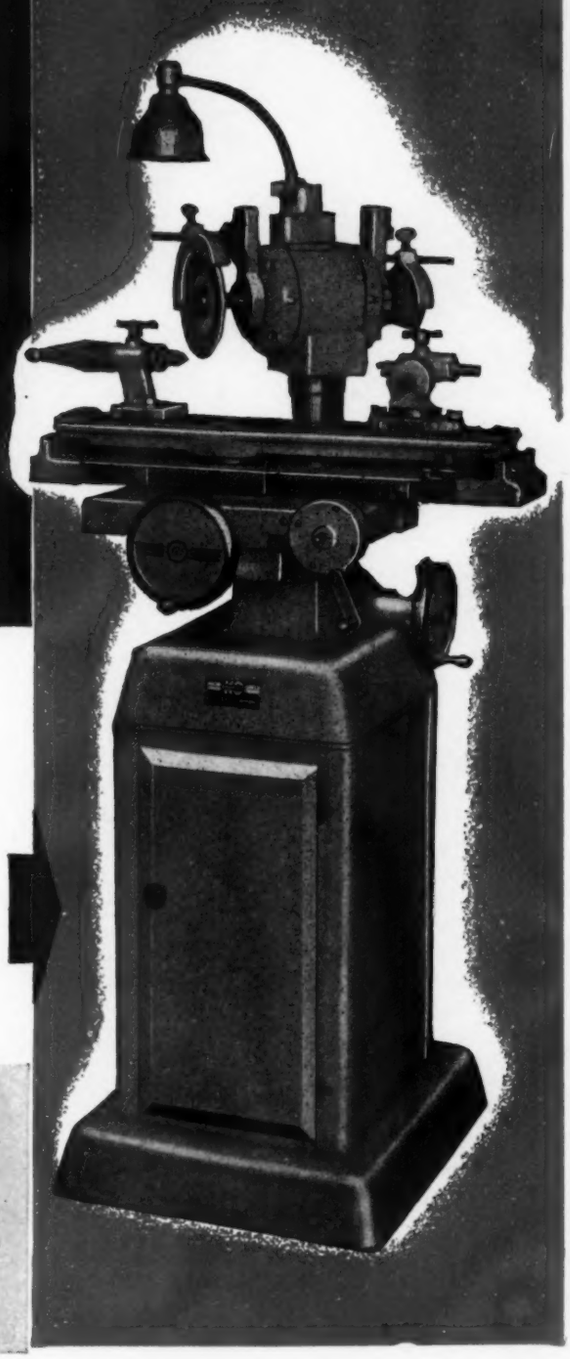
K.O. LEE COMPANY

ABERDEEN, SOUTH DAKOTA

Manufacturers of fine tools and equipment for over thirty years

"Knock-Out"

UNIVERSAL TOOL GRINDERS *and* CARBIDE TOOL GRINDERS

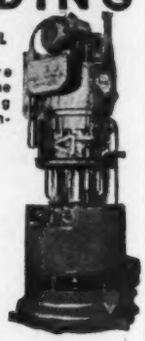


MILLING, DRILLING REAMING-

BORING and THREADING

PLANER TYPE MILLER
Open side, as well as, those with a combination of Vertical and Horizontal Heads are incorporated in this line.

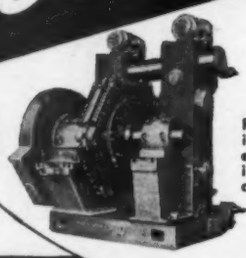
8 SV VERTICAL DRILLER
Operations are continuous of the non-indexing type. 8 or 10 spindles available.



Roto-Matic

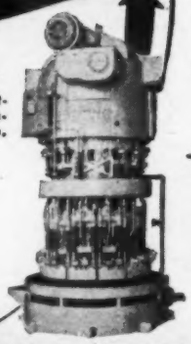
No. 1-A MILLER
One of a series of continuous operating milling machines adaptable to automatic or hand clamping.

DOUBLE END HORIZONTAL DRILLER
12 to 24 Spindles—self feeding—continuous operation—automatic chain or hand clamping.



No. 4 MILLING MACHINE
Roughing and finishing cutter spindles in each column with finishing spindles adjustable for toe cut.

12 V VERTICAL DRILLER
Continuous operating having a capacity of 1½ in. in steel.



MICROMETERS & GAGES
Hollow steel frames of highest quality construction give a lifetime of accuracy. Special designs available.

FOR ADDITIONAL INFORMATION ASK FOR CATALOG A-90

MACHINE TOOLS—
PIPE THREADING MACHINERY

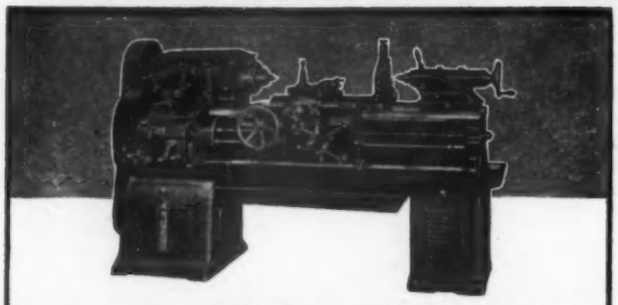
MICROMETERS — SNAP GAGES
SPECIAL TOOLS AND GAGES

DAVIS & THOMPSON COMPANY

MILWAUKEE

MFRS. OF MACHINE TOOLS & MICROMETERS

WISCONSIN



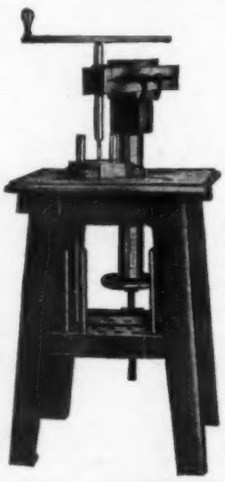
BRADFORD *Metalmaster* LATHE
have this standard equipment

- 12-Speed Timken Geared Headstock
- Quick Change Gear Device
- Double Wall Apron
- Tailstock
- Compound Rest
- Tool Post with Ring, Wedge, Square
- Steady Rest
- Face Plate
- Dog Plate
- Head Center Bushing
- Chasing Dial
- 2-Centers
- Wrenches
- Motor Mounting and Wiring
- Push Button and Starter
- Vee Belt Drive
- Automatic Lubrication in Head
- Cabinet Legs on Head and Tailstock End of Bed
- Lever Control for Length and Cross Feeds
- Mechanical Apron Clutch Control
- Threaded Spindle Nose

The BRADFORD MACHINE TOOL CO.

1840 – 1946 CINCINNATI, OHIO

PRODUCTO
UNIVERSAL
HAND TAPPING MACHINE



- Precision made for finest toolroom work on dies and fixtures.
- Has sliding arm with vertical, horizontal and lateral adjustments — to position taps in any place on the table.
- Taps readily in sizes from No. 5 to 1" diameter.
- It insures accurately tapped holes, preventing breakage.
- No setting up required.

Every toolroom and machine shop needs this inexpensive piece of equipment for fast, easy, accurate tapping of tool and alloy steels.

Also manufacturers of Producto Die Sets and Die Makers' Accessories.

Write for Bulletin Now

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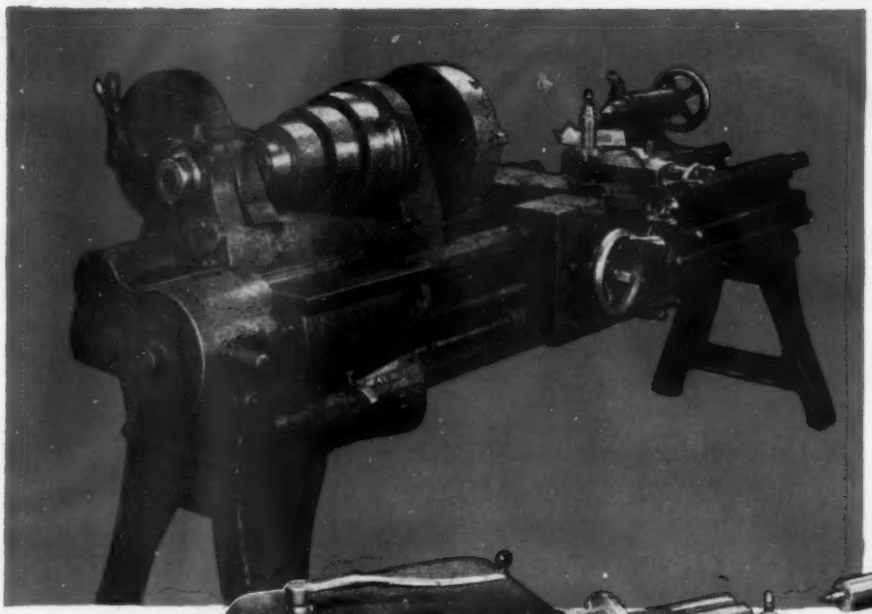
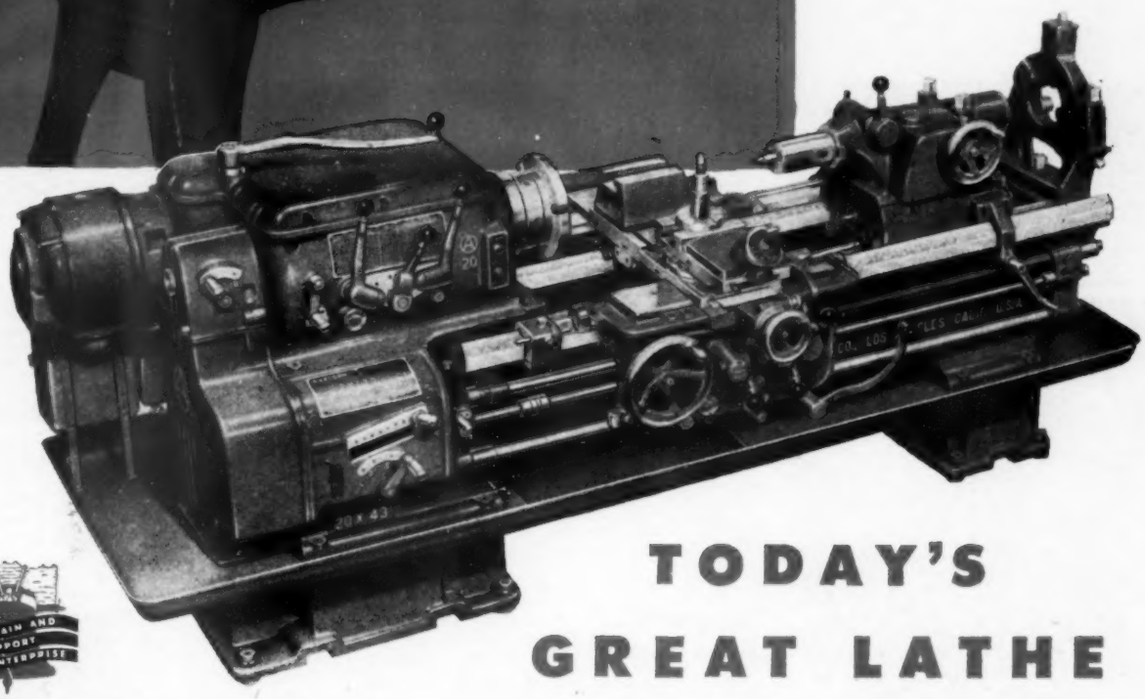
30 YEARS OF CONTINUAL IMPROVEMENT

...Results Speak for Themselves...



Recent photograph of an Axelson Lathe, manufactured in 1915, still in operation in the maintenance department of a Los Angeles heavy industry.



MAINTAIN AND SUPPORT FREE ENTERPRISE

Axelson Lathes of various lengths are manufactured in 14, 16, 18, 20, 25 and 32 inch sizes.

TODAY'S GREAT LATHE

Pictured above is today's truly great Axelson heavy duty Lathe, the product of more than thirty years of diligent determination to make this a quality machine tool. Quality determined by durability through advanced metallurgy. Quality developed by skilled and enterprising engineering. Quality proved by versatile, fast, close tolerance work on all jobs, big or little. Jobs that pay off by low production cost.

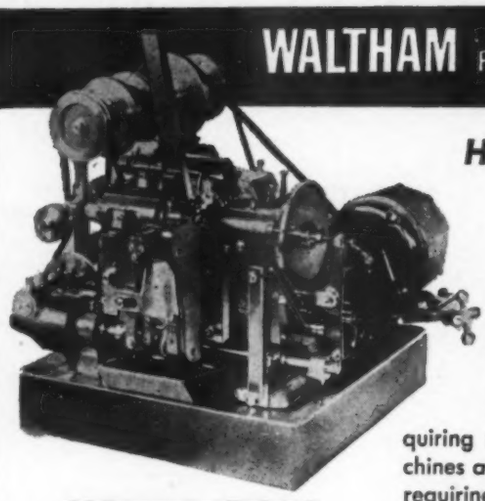
AXELSON LATHES

Dependable for over a Quarter Century

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

AXELSON MANUFACTURING CO.
6160 S. Boyle Ave. (Box 98, Vernon Station), Los Angeles 11, Calif. • 50 Church St., New York City 7
3844 Walsh St., St. Louis 16, Mo.

WALTHAM PINION & GEAR CUTTING MACHINES

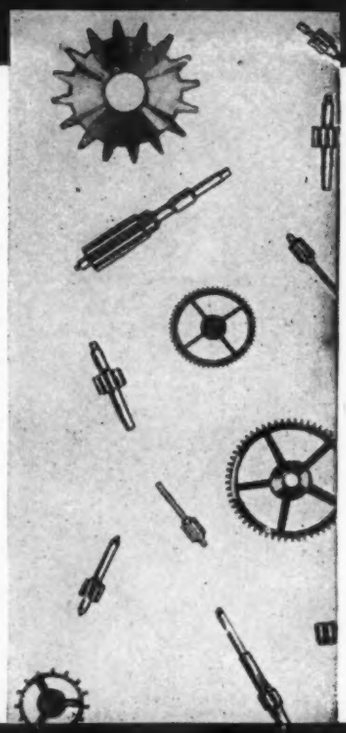


Highly productive—fast and accurate

These machines—made in single-cut, multiple-cut and magazine-feed types—are designed for the fast, precision production of gears and pinions for watches, instruments, fuses, etc. They are simple to operate, requiring no special skill. Magazine-feed machines are fully automatic, the other machines requiring positioning of blank and starting by hand.

Drive for these machines is either from countershaft or by individual motor. On motor driven machines, V-belts drive cutter spindle, worm shaft and pump.

Illustrated literature and detailed specifications are available promptly on request.



SPECIFICATIONS

PINION MACHINES

Diameter capacity, approx. ½"
Coarsest pitch about 32 D.P.
Strokes of Work slide for pinions—.24" to .45"
Strokes of work slide for stacked gears —.85 to 1"

GEAR MACHINES

Pitch diameter, capacity 1½"
Strokes for work slide, .40", .65", 1.00", 1.25"

WALTHAM MACHINE WORKS
WALTHAM, MASS.

WALTHAM
TRADE MARK
REGISTERED U.S PAT OFF

KEYSEATING
The Modern Way

Illustration shows typical set-up for cutting taper keyways with table tilted.

Machines are made in three sizes for keyways 1/16" to 1¼" in width.

Great simplicity and ease of operation of Davis Keyseaters assure the user of accurate, time saving work.
Let our engineer study your keyseating problems.

DAVIS KEYSEATER COMPANY
403 EXCHANGE ST. ROCHESTER 8, N. Y.

CLEVELAND
Automatic Tapping Machine

Taps better Threads—faster

★

Model DB with Special Rapid Approach

• • •

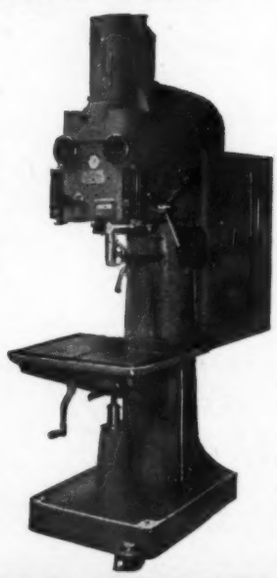
Give your tap a chance to produce better threads. Our lead screw completely controls thread accuracy through the entire tapping cycle, taking the load off the tap. As a result Class 3, 4 and 5 gauge fits are being produced on a production basis.

Five Outstanding Features

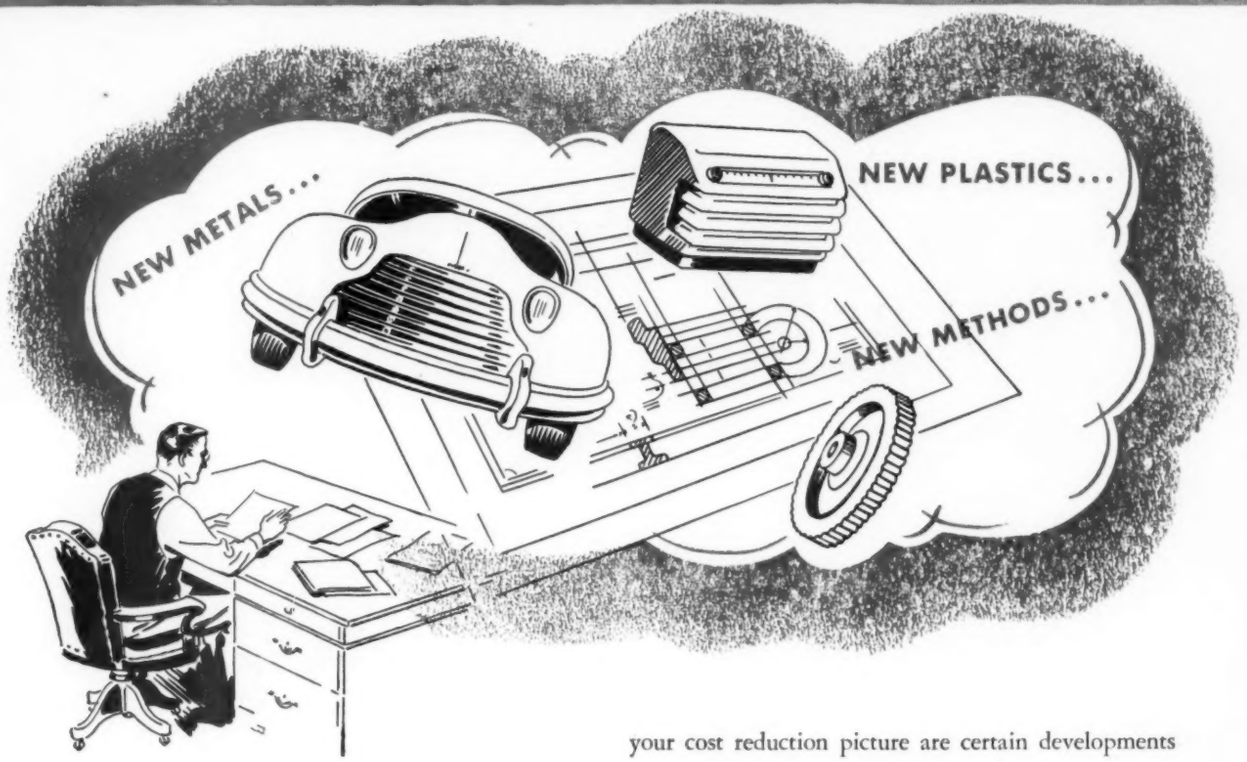
- Lead Screw Controlled
- 100 Per Cent Automatic
- Precision Depth Stop
- Split Second Reverse

Full descriptive bulletin available Write for your copy today.

Also designers of Special Tapping equipment.



THE CLEVELAND TAPPING MACHINE CO.
3610 Superior Avenue • Cleveland 14, Ohio



Don't forget... new war-born cutting oils can help cut costs, too

YOU HAVE undoubtedly been figuring out ways of cutting costs and improving your products through war-developed methods and materials. New metals, as well as new plastics and other synthetics, offer remarkable opportunities.

Less spectacular but perhaps just as important in your cost reduction picture are certain developments in cutting oils and coolants.

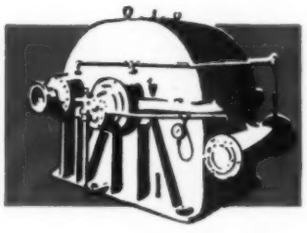
Many of these products were entirely unknown before the war. They are as new as radar. Others are improvements of established products. All provide better finish, longer tool life, higher rate of production, or other improvements that affect costs of machined parts.

The Standard Oil line is studded with these advances, and because their application is normally a specialized job, Standard Oil maintains a group of Cutting Oil Specialists to consult with the industry. These men are thoroughly familiar with new developments in metal working and with the cutting oils and coolants available today. Get the expert advice of one of these specialists when studying your cutting oil problems. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

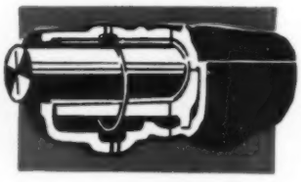
STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

Improved STANOILS

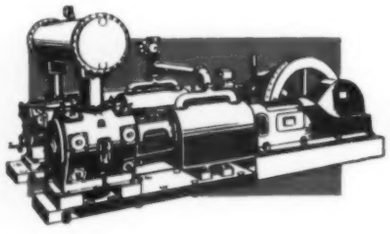
...last longer in gear cases



...in bearings



...in compressors



...and hydraulic systems

STANOILS have long been outstanding for relative freedom from deposit formation, and for their long lasting quality in all types of service. Now by the addition of an oxidation inhibitor, developed by Standard Oil, the oxidation stability of Stanoils has been improved many-fold.

With improved Stanoils, oil acidity will remain at a safe low figure for long periods of operation. At the same time, deposit formation is practically eliminated. In addition, an effective defoaming agent is used.

These advantages can be secured for a variety of applications, because improved Stanoils are available in a wide range of viscosity grades. In fact, you may find that Stanoils can be applied to all your lubricating jobs, with consequent simplification of ordering and stocking.

A Standard Oil Lubrication Engineer will be glad to help you test improved Stanoil and point out equipment in your plant in which the high stability and clean operation of Stanoil can save maintenance time and money. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you.

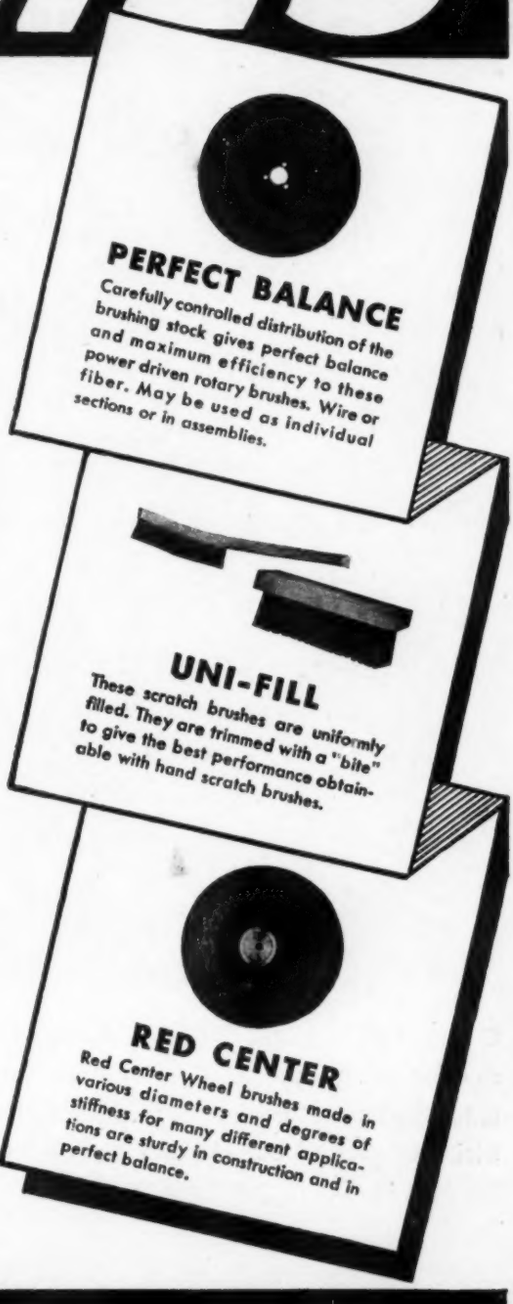
STANDARD OIL COMPANY (INDIANA)

STANDARD SERVICE

Industrial
BRUSHES

OF ALL TYPES FOR BETTER PRODUCTION *and* MAINTENANCE

Consult with our engineering representatives. They will gladly work with you in developing "Even Trim" Spiral Wound Brushes, of wire, horsehair or tampico, to meet your particular finishing requirements.


PERFECT BALANCE
Carefully controlled distribution of the brushing stock gives perfect balance and maximum efficiency to these power driven rotary brushes. Wire or fiber. May be used as individual sections or in assemblies.
UNI-FILL
These scratch brushes are uniformly filled. They are trimmed with a "bite" to give the best performance obtainable with hand scratch brushes.
RED CENTER
Red Center Wheel brushes made in various diameters and degrees of stiffness for many different applications are sturdy in construction and in perfect balance.

Brush Division
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PLATE GLASS COMPANY

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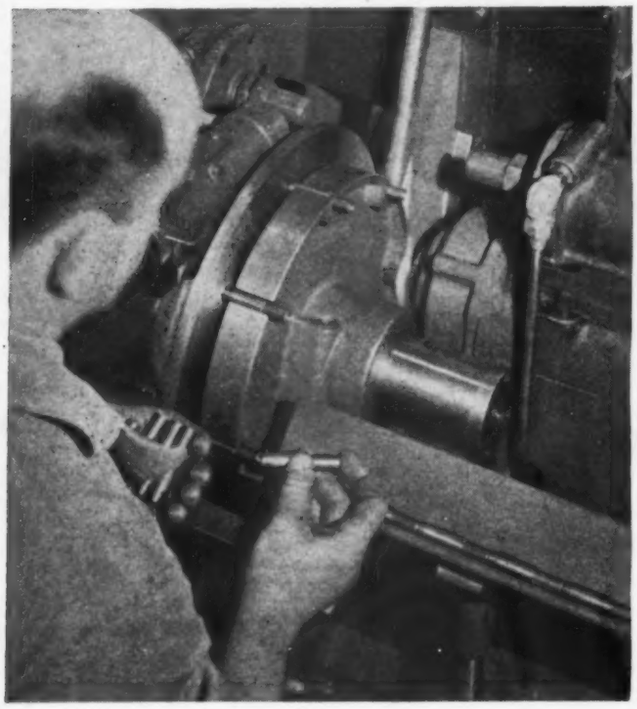
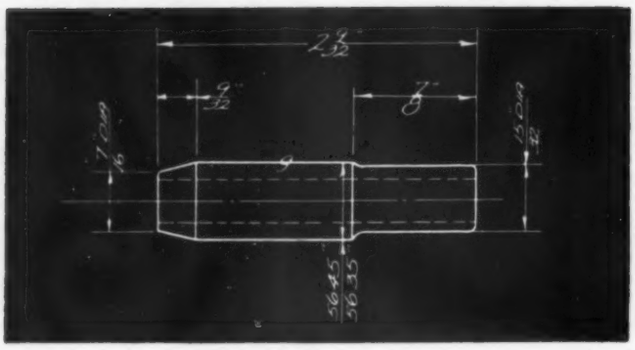
MARYLAND



ARTER 135

Automatic Cylindrical Grinder

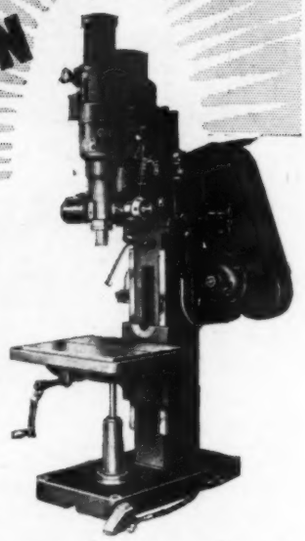


On this VALVE STEM GUIDE-JOB there is no necessity for using arbors. Special low angle centers enter the bore at each end, thus controlling concentricity of ground outside diameters with the bore. Production—700 per hour within .001" (.002" indicator).

This VALVE STEM GUIDE is but one of many jobs for which this versatile machine can be tooled.

ARTER Grinding Machine Co.
WORCESTER, MASS.

FOR CONTINUOUS HIGH DUTY PRODUCTION



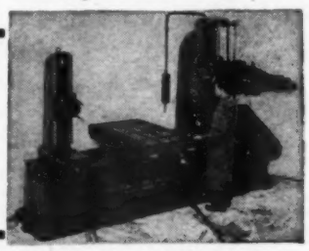
Kaufman No. 10A Hi-Duty single spindle. Lead Screw Tapper made in 3 HP and 1½" HP models with ¾" N.C. and 1½" N.C. Threads in alloy steel offers these features: Fully enclosed . . . lead screw and nut operate constantly in oil bath . . . positively wear-proof clutches instantly engaged and controlled by air cylinder . . . quick traverse when not actually cutting threads . . . accurate depth control . . . control to protect tap overload, and further protected against jamming if work is placed in upside down . . . class 3 fits always assured and perfectly controllable.

Complete information upon request.

KAUFMAN MFG. CO.
MANITOWOC, WISCONSIN

UNIVERSAL *Horizontal Boring Machine*
The only TRIWAY *Boring Machine Built*

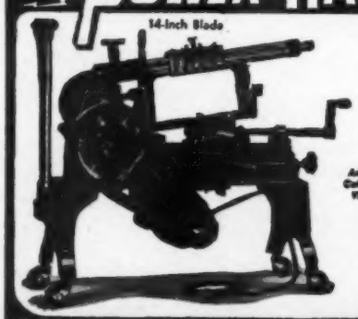
Made in 3", 4" and 5" spindle sizes.
Write for complete, detailed specifications.



Standard Universal 3" Spindle Machine

UNIVERSAL BORING MACHINE CO.
Hudson, Mass., U. S. A.

POWER HACK SAW



LOW PRICED
SELF-CONTAINED
PORTABLE
STURDY
READY TO WORK
ECONOMICAL

EXPORT DEPT.
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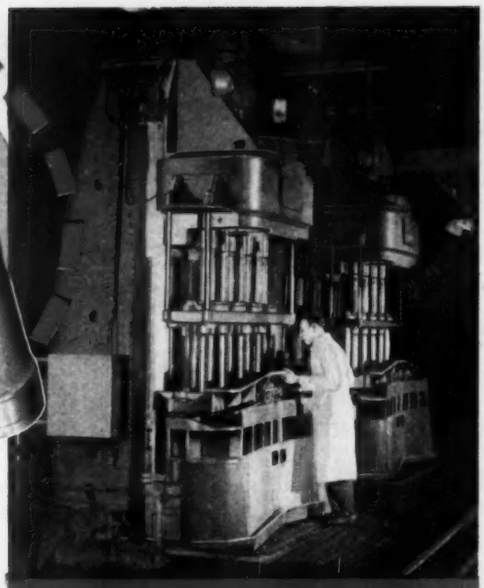
NEW YORK 4, N.Y.

WRITE FOR BULLETIN NO. 400

MILLER-KNUTH MFG. CO. OMAHA, NEB.

19 Cylinder Liners Finish Bored Every Hour



Installation view of two W. F. and John Barnes Vertical Boring Machines for finish boring of cylinder liners in prominent tractor plant.

PRODUCTION SPEEDED AND COSTS LOWERED WITH W. F. AND JOHN BARNES VERTICAL BORING MACHINE AND SPECIAL FIXTURE

Four cylinder liners, each 15-3/64″ long, are *finish bored* on this W. F. and John Barnes Vertical Boring Machine, with dimensions held to 5.748″–5.746″. In an hour, including loading time, 19 cylinders are machined. Two Barnes Vertical Boring Machines are used on this job, allowing the operator to load one machine while the other is in operation.

The simultaneous boring of four cylinder liners increased production substantially and reduced manufacturing costs materially. Engineering collaboration enabled this tractor manufacturer to use their own facilities to speed delivery of these machines. While Barnes built the basic machine, the manufacturer designed and built the special work holding fixture.

View of special work holding fixture, manually operated, showing cylinder liners in fixture prior to finish boring operation. This work holding fixture was designed and built by the manufacturer in co-operation with Barnes engineers.

Better Solutions for Your Metal Working Problems

Whether you require equipment to fit into your present production lines, or need assistance in laying out a new method of processing your part, there is a Barnes Special Machine Tool which produces more and better work at lower costs.

Multiple machining operation, which include high production *drilling, reaming, boring, tapping, chamfering, milling, hollow milling* and *facing,* can, in many instances, be combined in ONE Barnes machine, thus eliminating standard machines doing these individual operations.

If you have metal working problems, Barnes engineers will cooperate with you in designing Special Machine Tools for your specific needs. Their experience offers higher production with more accurate work, better finishes and less work spoilage.

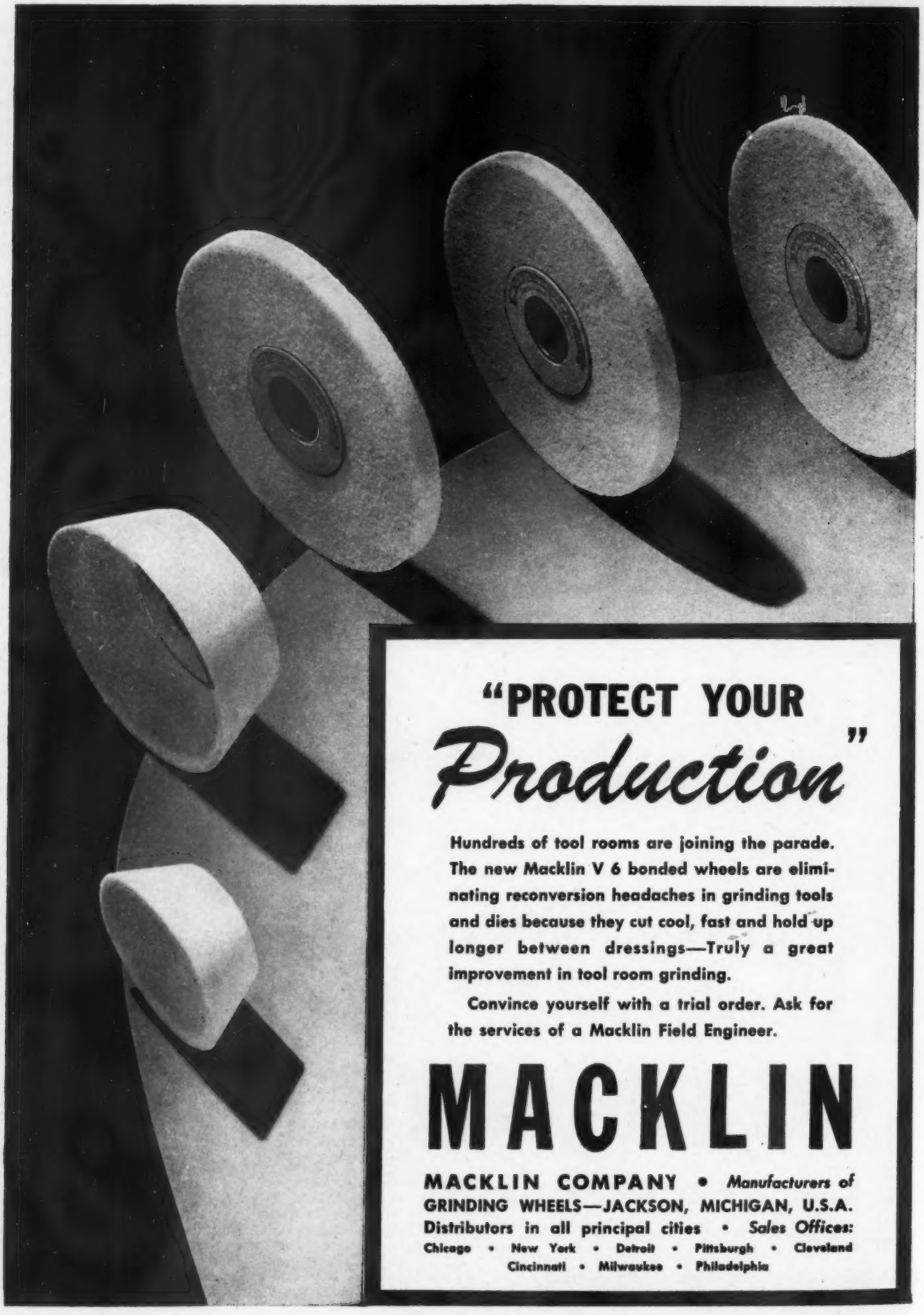
What Others Have Done With Barnes Special Machine Tools . . .

The Barnes "Special Machine Tools" Book shows you how a wide variety of machining problems have been solved by W. F. and John Barnes Company engineers. Complete tooling and production data is given together with other interesting information. Key production personnel can get their free copy when requested on company letterhead. Ask for Book 446.

W. F. & JOHN BARNES

W. F. and JOHN BARNES

310 SOUTH WATER STREET • ROCKFORD, ILLINOIS, U.S.A.



"PROTECT YOUR *Production*"

Hundreds of tool rooms are joining the parade. The new Macklin V 6 bonded wheels are eliminating reconversion headaches in grinding tools and dies because they cut cool, fast and hold up longer between dressings—Truly a great improvement in tool room grinding.

Convince yourself with a trial order. Ask for the services of a Macklin Field Engineer.

MACKLIN

MACKLIN COMPANY • *Manufacturers of* **GRINDING WHEELS—JACKSON, MICHIGAN, U.S.A.**
Distributors in all principal cities • *Sales Offices:*
Chicago • New York • Detroit • Pittsburgh • Cleveland Cincinnati • Milwaukee • Philadelphia

Do it with DALZEN

Left: Dalzen taps, in U. S., Metric, Whitworth, and Special forms are precision ground of hardened high speed steel in a complete size range. TUNGSTEN CARBIDE TAPS — EITHER SOLID OR INSERT—A SPECIALTY.

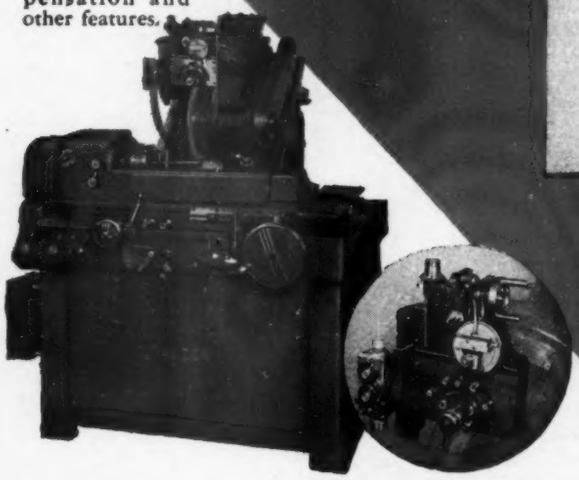
Left: High speed ground thread milling cutters, scientifically heat treated for longer cutting life

Dalzen manufactures an extensive line of precision cutting tools, parts, thread grinding and special machines — engineered for maximum efficiency and economical operation. Each is the result of years of experience on the part of designers and craftsmen. These are reasons why, all over the United States and in many foreign countries, master mechanics who have used and worked with Dalzen-made machines and tools say, "You can do it better with Dalzen." Write for details on how Dalzen can "do it better" for you.

Below: Dalzen "2-in-1" combines a dependable, accurate centerlapping machine with a sturdy drill press. Saves on equipment costs, floor space.

Below: No. 5 *Electronic* Thread Grinder. Easy to operate. High production efficiency and accuracy by controlled wheel speed, motor driven dresser, automatic compensation and other features.

Right: No. 2 Thread Grinder. Compact, upright design saves floor space. Simple to operate. Low first and maintenance cost. Ideal for short or production runs.



Right: Threaded parts are ground to close tolerances exactly to your specifications. Rigid inspection standards assure a uniform fine finish. Jobs requiring rolled or cut threads are also handled.

DALZEN

TOOL AND MANUFACTURING CO.

12255 EAST EIGHT MILE ROAD • DETROIT 5, MICH.

MOREY *Universal* TURRET LATHES
for BAR or CHUCKING

THE TURRET LATHE *Your Operator* APPROVES!

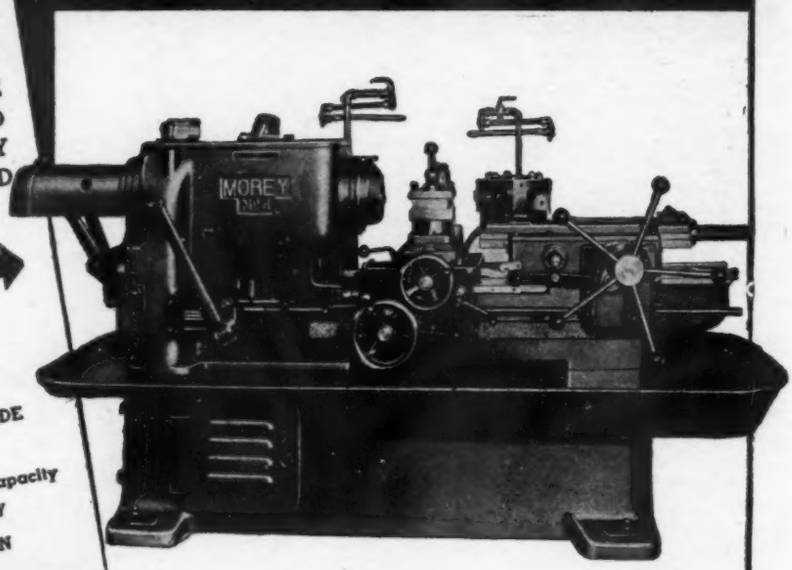
EASY TO OPERATE • ACCURATE
DEPENDABLE • RIGID AND
POWERFUL ENOUGH TO FULLY
UTILIZE PRESENT-DAY HIGHSPEED
CARBIDE TOOLS

#4 UNIVERSAL

For bar stock up to 2" in diameter
12" turning length 19½" swing over bed
Infinite spindle speeds: 35 to 1500 RPM.
constant speed motor, 1200 RPM
MAY BE HAD WITH PLAIN CROSS SLIDE

Also available in
No. 3 Universal, 1½" capacity
No. 2 Plain, 1" capacity

ASK FOR DESCRIPTIVE BULLETIN



STOCK DELIVERY

DESIGNED AND BUILT BY
MOREY MACHINERY CO., INC 410 BROOME STREET, NEW YORK 13, N. Y.
PLANT: 4-57 26TH AVE., ASTORIA 2, NEW YORK

INDUSTRY'S NEW SET OF TOOLS

Contour Sawing

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Magnetic Chucks and Selectron

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Dust Collector

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Baltimore	SA 5778	Denver	KE 7511									Pittsburgh	AT 3386	San Francisco	GA 4784
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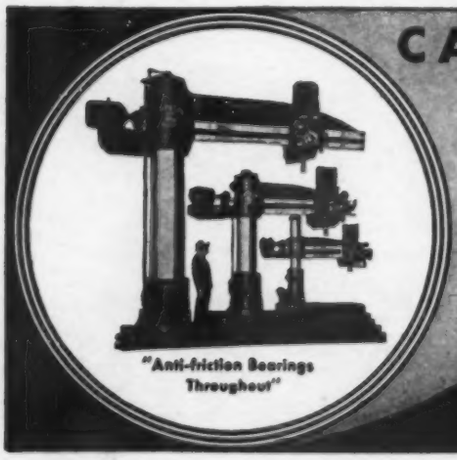
The **DoALL** *Company* Minneapolis 4 Minnesota

PHONE ANY OF THESE DoALL STORES

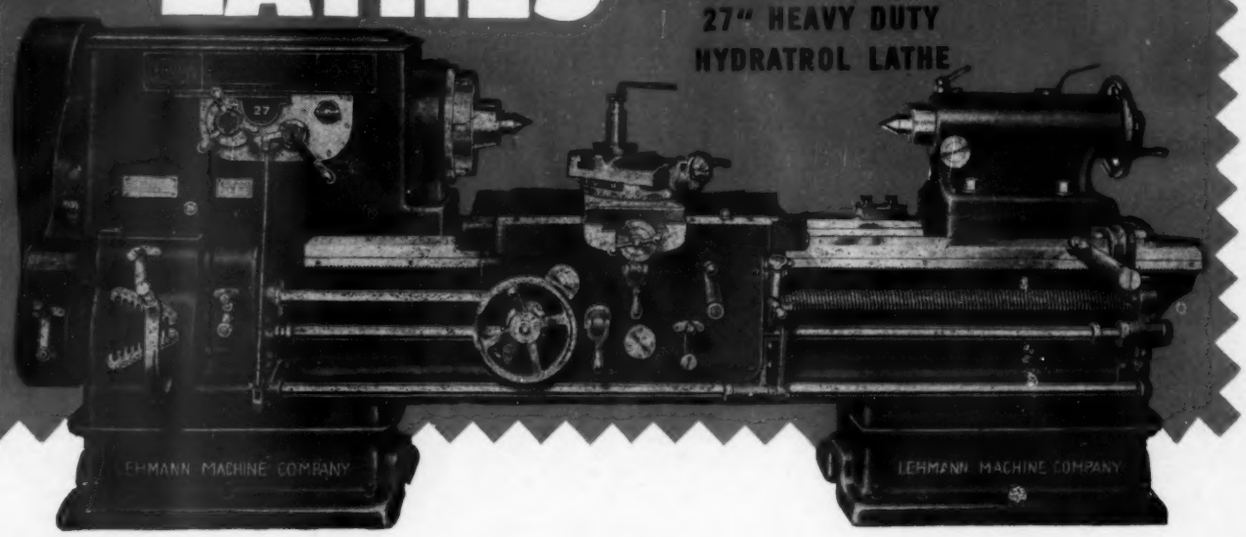
CARLTON RADIAL DRILL


"Anti-friction Bearings Throughout"

FEATURES—1. Low Hung Drive to the Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all speeds. 4. Concentrated and Convenient controls. 5. Constructed on Unit Principal.

The **CARLTON**
MACHINE TOOL COMPANY
CINCINNATI, OHIO, U. S. A.

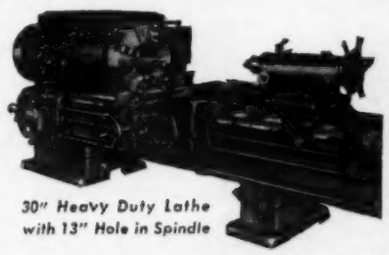
Check these 7 Features of HYDRATROL LATHES



7 Features of Superiority

- Hydraulically-operated Speed Changes.
- Simplicity in Construction; Simplicity and Safety in Operation.
- Automatic Slide Rule indicates spindle speeds, operation numbers, cutting speed.
- Hydraulic Friction Clutches and Hydraulic Brakes, self-compensating.
- Automatic Safety Relay, for harmless and easy engagement of positive clutches when speeds are changed.
- Spindle Release for Chucking.
- Perfect, Safety-Control Lubrication with Filtered Oil.

Send prints for a time-and-money-saving recommendation.



30" Heavy Duty Lathe with 13" Hole in Spindle

LARGE HOLLOW SPINDLE TYPE

5 SIZES—18" to 36"

Small	18" up to	7½" Hole
Medium	24" up to	12" Hole
Large	27" up to	13" Hole
Large	30" up to	14" Hole
Large	36" up to	16½" Hole

(Standard type lathes, 16" to 36")

LEHMANN MACHINE COMPANY, ST. LOUIS 3, MISSOURI

HYDRATROL LATHES

(HEAVY DUTY TYPE)

● Williams "Superior" Wrenches are drop-forged from a selected grade of carbon steel and processed to exacting specifications. They are substantially twice as strong as the earlier carbon steel wrenches of our own manufacture. Comparative tests show that these wrenches *average* 93% as strong as our corresponding alloy steel wrenches costing approximately twice as much.

Most industrial users find Williams "Superior" Wrenches their logical choice considering both strength and economy. "Superior" Wrenches are made in 50 patterns . . . more than 1,000 sizes, and are sold by Industrial Distributors everywhere.

J. H. WILLIAMS & CO., BUFFALO 7, N. Y.

WILLIAMS

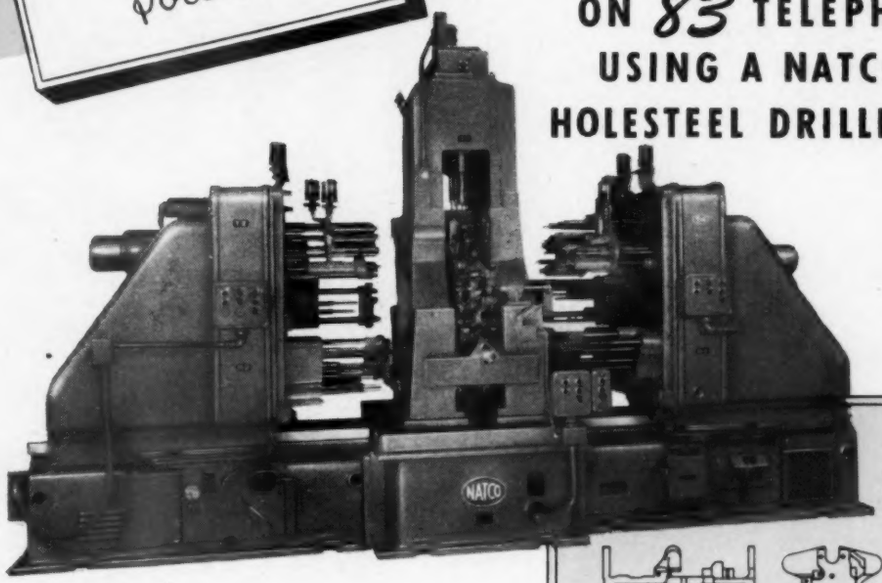
DROP-FORGINGS AND DROP-FORGED TOOLS

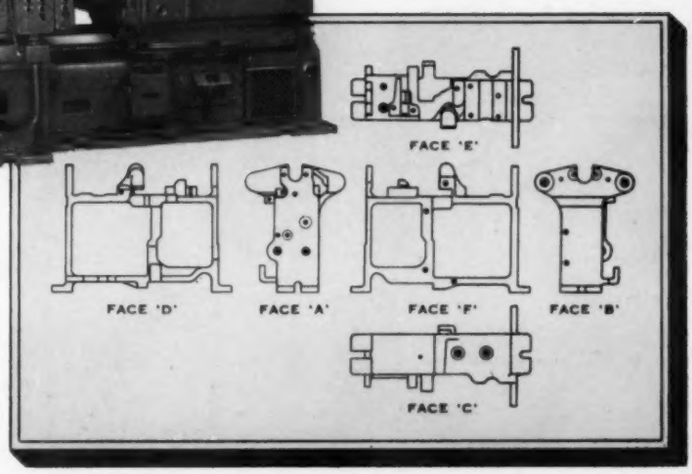
Drill 3071
Ream 332
Spotface 498
C'Bore 249
Tap 2241
Total 6391

a total of 6391 Operations every hour

ON 83 TELEPHONE FRAMES USING A NATCO FOUR WAY HOLESTEEL DRILLER AND TAPPER

NATCO





The operations performed on this machine include the drilling, reaming, counterboring, spot-facing and tapping of all holes on each of the six sides.

21 operations are performed on Face A, 20 on Face B, 7 on Face C, 2 on Face D, 17 on Face E and 10 on Face F. The holes vary in sizes from .099 to .290 inches.

NATCO SOLVES YOUR "HOLE" PROBLEMS

NATCO Way Type Machines are engineered to perform a multiplicity of operations on parts varying from small castings to extremely large and heavy parts. These machines, whether for small, medium, or large parts, are designed to reduce operator fatigue, lessen scrap through the maintenance of required tolerances and lower costs per hole by being engineered for the job.

If you are experiencing problems in your drilling or tapping departments they are needless worries. Call or write *our* nearest Office, present your problems and rest assured that with a NATCO you can again depend on required production in your drilling and tapping departments.

Let NATCO solve your Hole problems with a machine engineered to your production requirements.

National Automatic Tool Company, Inc., Richmond, Ind.

MULTIPLE DRILLING, BORING, AND TAPPING MACHINES

INVESTIGATE NATCO METHODS FOR THE LOWEST POSSIBLE HOLE COSTS!

SALES OFFICES: 1809 ENGINEERING BUILDING, CHICAGO; 409 NEW CENTER BUILDING, DETROIT; 1807 ELMWOOD AVENUE, BUFFALO; 2902 COMMERCE BUILDING, NEW YORK CITY

PRECISION REID SURFACE GRINDERS

ASSURES PRECISION RESULTS

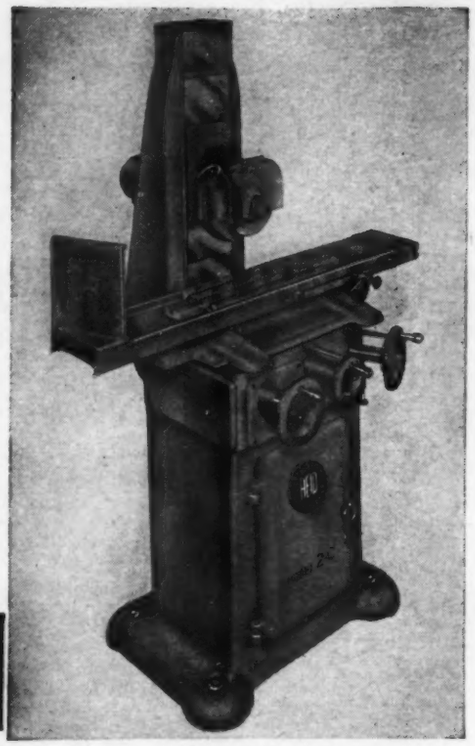
THOUSANDS OF REID

Precision grinder users in nearly every country vouch for their constant precision results. There are REID grinders in operation convenient to your location.

(ADDRESSES ON REQUEST)

Illustrated is Model 2-C Reid Hand-Feed Surface Grinder. This machine is highly recommended for close tool, gage and die work and certain production grinding.

EXCELLENT DELIVERIES
Distributors Conveniently Located in All Sections.
Write Dept. "H" for Bulletin.



REID BROTHERS COMPANY, INC.
BEVERLY MASSACHUSETTS

Simple, fast and automatic finishing is assured by the
No. 101 "PRODUCTION"

Work of superior quality can be produced on this machine which is adaptable to polishing, finishing and buffing any cylindrical work. Can be furnished in tandem of two or more for multiple finishing.

Write for illustrated folder.

Features include: A sturdy wheel head, simple wheel trueing device for use with wheels in motion, patented centerless feed and adjustable work support. All parts guarded but easily accessible. Handles work from 1/4" to 6" diameter.

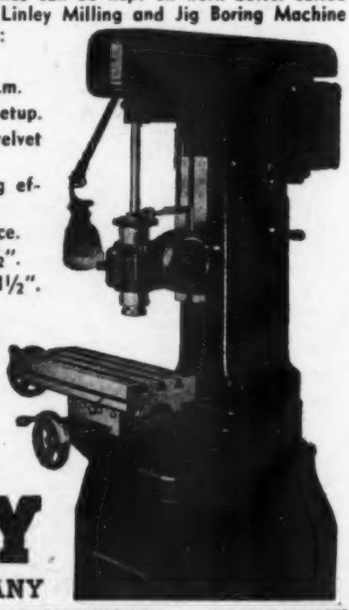
PRODUCTION MACHINE CO.
Manufacturers of Tool Grinders and Hand and Automatic Polishing and Grinding Machines.
GREENFIELD, MASS., U. S. A.

HERE'S WHY* THE LINLEY *IS A

TOOL ROOM FAVORITE

A small machine that mills and jig bores a wide variety of dies, patterns, models, jigs and fixtures, quickly and accurately—saves time and money. Larger machines can be kept on work better suited to their rated capacities. The Linley Milling and Jig Boring Machine can do this because it features:

- 8 spindle speeds to 4250 r.p.m.
- Rapid changeover . . . quick setup.
- Direct micrometer setting, velvet feed.
- Parts balanced for operating efficiency.
- Fits in 2½ sq. ft. floor space.
- Ample table size, 7" x 17½".
- Table top to spindle end, 11½".
- ½ h.p. motor.



Look into these profit factors . . . now.

Informative Bulletin on Request

LINLEY
BROTHERS COMPANY
664 STATE ST. EXTENSION BRIDGEPORT 1, CONNECTICUT

Geargrind Announces

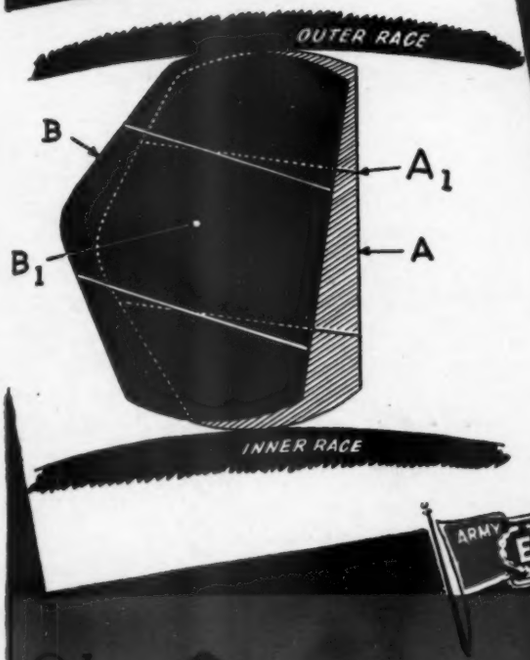
FORMSPRAG

THE FULL COMPLEMENT

Over-Running Clutch

CENTRIFUGALLY CONTROLLED FRICTIONLESS OVER-RUNNING at HIGH SPEEDS

At selected speeds, centrifugal force overcomes the force of the energizing spring and establishes an *actual clearance* between sprag and inner race. Sprags contact both races again when speed drops to the selected R.P.M.



When centrifugal force, acting on the center of gravity B_1, exceeds the energizing action of the spring, the sprag takes position B, completely clearing the inner race and permitting free running.

As speed decreases, the energizing action of the spring, exerted at A_1, exceeds centrifugal force and the sprag returns to position A, in contact with both inner and outer races.

Sprag design and spring tension permit the clutch to function at predetermined speeds. In the arrangement shown, centrifugal throw-out occurs when the speed of the outer race and sprags exceeds that of the inner race.

ARMY E NAVY

The GEAR GRINDING MACHINE COMPANY

DETROIT 11, MICH. U.S.A.

35TH ANNIVERSARY YEAR
1911-1946

Midwest

INSERTED BLADE CUTTING TOOLS *are Engineered to Cut Costs by Combining Operations*

USING inefficient, only partially applicable tools on a production job, represents a continuing manufacturing loss—a loss that carries beyond a judicious investment in tools designed for the job.

Midwest Inserted Blade Metal Cutting Tools engineered at Midwest to assure fast, accurate work and fine finish, and combining otherwise separate operations, will reduce your manufacturing costs as they have in a wide variety of concrete instances.

Let us study your particular metal cutting problem and provide suggestions. Efficient tooling means profitable production. Write us today.

If you wish a copy of this bulletin, write us on your company letterhead

Hy-Pressure Lock Inserted Blade Cutter Bulletin 1144

Midwest Tool

CARBIDE TIPPED TOOLS • MILLING CUTTERS • FORM TOOLS
COUNTERBORES • EXPANSION REAMERS • RECESSING TOOLS
CORE DRILLS • SLEEVES • ADJUSTABLE HOLDERS

MIDWEST TOOL & MFG. CO.
2356 W. JEFFERSON AVE., DETROIT 16, MICH.

Makers of Fine Tools Since Nineteen Eleven

ALLMETAL CUTTING TOOLS

For All Metal Cutting Jobs

Standard tools of all grades . . . General Purpose, Cast Alloy, and Tungsten Carbide. Three of a kind when it comes to quality, a Delloy tool, bit, or tip will do the job better and faster. Delloy tools hold their edges longer, thereby increasing the number of pieces produced by cutting the downtime. Prove it today by sending for samples of the size and type of cutting tool you are now using.

If you can't tolerate the tolerances you are getting . . . if you have a problem in turning, boring, planing, or facing, don't let idle machines and men fatten your overhead . . . talk over *your* problem with Delloy. Delloy's skilled staff of tool designers and metallurgists will produce the best and proper grade of tool for your particular job. Send a blueprint, sketch, or sample. Our complete grinding department assures quick delivery on special tools. Standard tools stocked for immediate delivery.

Delloy
METAL CORPORATION

CUTTING TOOLS

Affiliate of Ace Manufacturing Corporation

1203 East Erie Ave., Philadelphia 24, Pa.

Sales Representatives in all Principal Cities

NEW...

GREATER PRECISION AND PRODUCTION FOR TOOL ROOMS!

No. 22 Horizontal Boring, Milling, Drilling and Tapping Machine . . . for tool room work, light production and adaptable for making plastic molds.

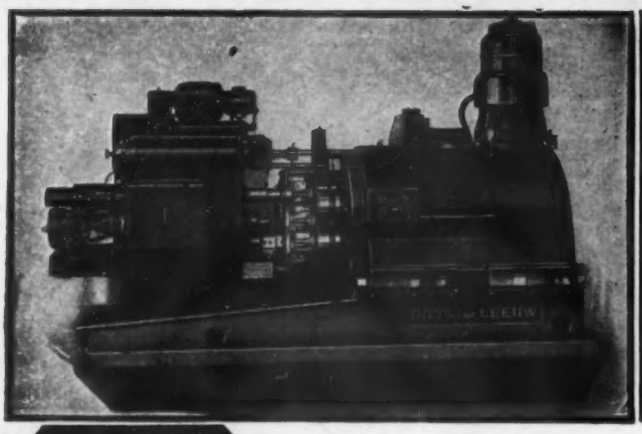
- ★ Positive infinitely variable high speeds from 25 to 1600 R. P. M. in either direction directly on the main spindle giving complete range of speeds in one spindle.
- ★ 18 feeds in geometric progression, ranging from .002 to .125 per revolution of spindle. Five feeds are standard tapping leads.
- ★ Direct reading indicator for feeds and spindle speeds.
- ★ Speed and feed mechanism, and spindle housing are of unit construction.
- ★ Fast travel to all units.
- ★ Spindle and feed units run in bath of oil.
- ★ Column ways are extra wide... 5″ x 1½″ and 18″ across. Bed ways are 5″ x 1½″ and 24″ across. Table ways are 4″ x 1½″ and 22″ across.
- ★ Complete oversize construction to insure rigidity, strength and accuracy.
- ★ Extremely long saddle ways to support table.
- ★ 24″ x 36″ table has working surface of its entire area with "T" slots and cross slots.

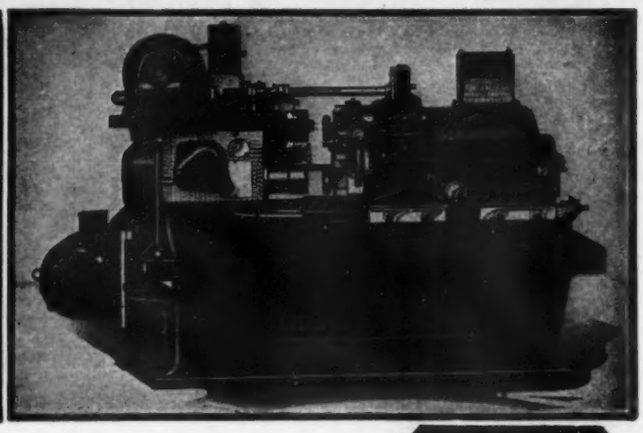
Write for bulletin.
Defiance MachineWorks, Inc.,
Defiance, Ohio.

DEFIANCE

95 YEARS OF PRECISION MANUFACTURING

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES





TOOL ROTATING TYPE
4 Spindles
5 Chucking Positions

Features include:

Lead Screw Threading on both types—Preloaded Anti Friction Spindle Bearings—Hardened Ways—Oversize Spindles—Gears of Chrome-nickel steel, carefully heat-treated.

Write for copy of descriptive catalog giving complete, detailed specifications.

WORK ROTATING TYPE
5 Spindles
6 Spindles
8 Spindles

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

SPEED IN COLD METAL SAWING

The PORTER - McLEOD IS DESIGNED FOR HIGH SPEED COLD METAL SAWING

Straight, clean cuts on a truly high production basis are assured by the 8" Porter-McLeod. It is a compact, sturdy, amply powered unit designed for handling general or production work with utmost operating convenience and control. Economical quantities of bars or shapes can be "nested" and held rigidly during cutting by means of supports provided on sides and bottom combined with clamping pressure at top.

In the Porter-McLeod, the blade is supported for accurate cutting and for protection against damage. Adjustment is also provided for changes in blade thickness. Feed of blade is upward to stock with provision made to prevent weaving and buckling. Standard feeds up to 3" per minute are available. Protection against blade breakage due to hard spots in stock is provided by a friction feed disc.

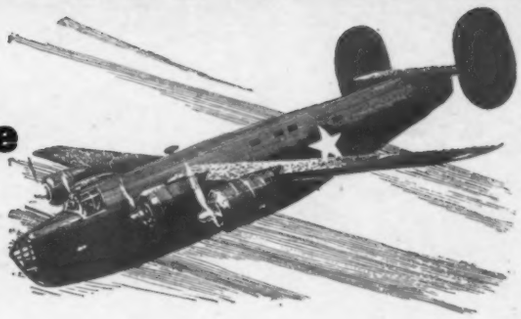
This machine will handle either 8" round or 7½" square stock or the equivalent in "nested" work.

Investigate the high production possibilities of this machine by sending for descriptive Bulletin.

MACHINE TOOL COMPANY

PORTER-McLEOD MACHINE TOOL CO., INC.
HATFIELD, MASSACHUSETTS, U.S.A.

Wickes Automatic Center Drive Crankshaft Lathes

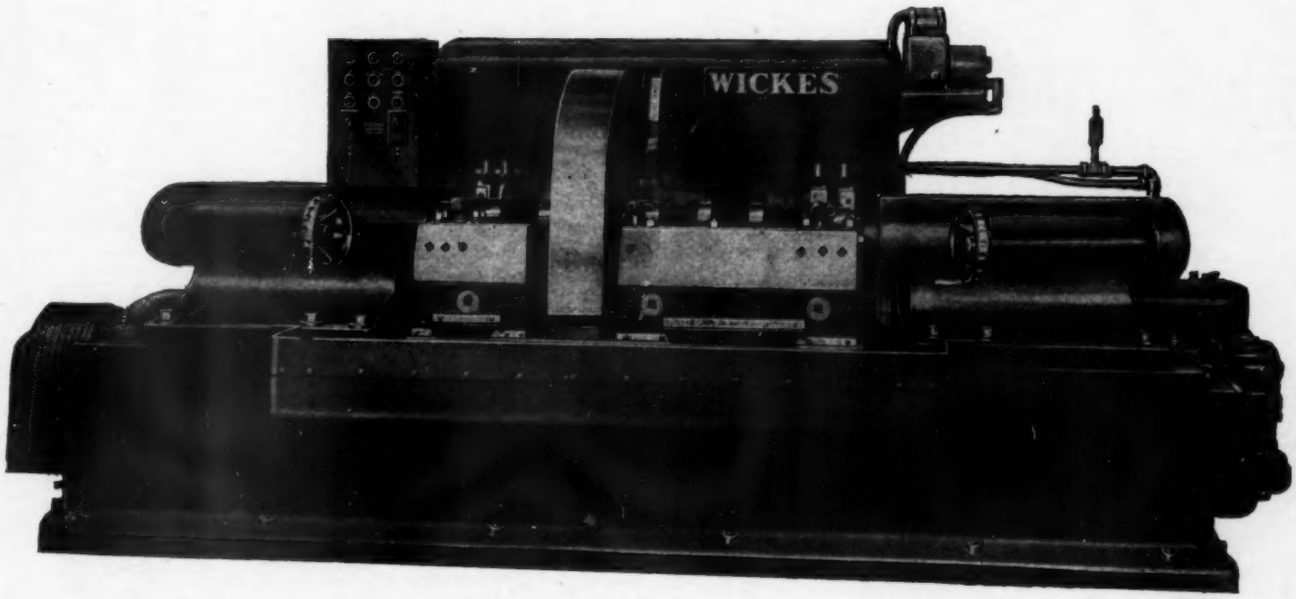


The Wickes Automatic Center Drive Lathe is designed for completely and automatically machining the main line bearings, stub end, flange and oil slinger on crankshafts. Of the latest design streamlined and efficiently designed for ease of operation and maintenance, this Wickes Lathe is compact, requires a minimum of floor space. Lathe bed is wide and well ribbed; spindles are of large diameter high-carbon forged steel and ground to size. Hydraulic equipment is of variable delivery type so that lathe is readily adaptable for changes in design or character of metal in crankshafts being machined.

When production is small, one lathe may be provided with several sets of tooling, arranged for machining different sizes and types of cranks.

Usually, a duplicate lathe is used for finish-turning and filleting of main line bearings and for the finish-turning of both ends of the crankshaft. This operation is performed immediately after the roughing operation in the Roughing Lathe and thus replaces rough grinding and saves considerable labor and cost.

Write for more complete information about Wickes Center Drive Lathes.



Wickes Lathes CUT COSTS • SPEED PRODUCTION

WICKES BROTHERS • SAGINAW, MICHIGAN • RECOGNIZED QUALITY SINCE 1854

Crankshaft Turning Equipment • Camshaft Turning Equipment • Double End Boring Lathes • Heavy Duty Engine Lathes • Special Production Lathes • Blue Print Machines

PACEMAKERS OF PRODUCTION!

DESIGNED AND BUILT BY BUHR FOR MULTIPLE OPERATIONS.

Retooling old machinery for modern production lines is no problem for Buhr Engineers are specialists on multiple-spindle drilling, reaming and tapping operations. Many seemingly impossible production problems have been solved quickly by our staff of qualified men.

TYPICAL BUHR RETOOLING

1—24 Spindle Drill Head arranged with 12 Spindles for Drilling and 12 Spindles for Reaming.

1—2 Compartment Bushing Plate with automatic cut off of compound in non-operating position.

1—Holding Fixture mounted on rolling type index. Loading position left, drilling center and reaming position right.

All gears in Buhr Drill Heads are shaved and induction hardened for quieter, frictionless operation, lower power consumption and more trouble-free production hours.

RETOOL *with* BUHR

BUHR MACHINE TOOL COMPANY

837 GREEN STREET
ANN ARBOR, MICH.

Sensitive and VERSATILE

The Hamilton Varimatic Super-Sensitive Drilling Machine

If your production entails the drilling of small holes (.004" to 5/16" in all drillable materials) this machine was made for you.

With infinite variation of spindle speeds, in two ranges, between 840 R.P.M. and 9300 R.P.M., instantly available by the simple use of a hand wheel and graduated speed dial; with ample clearances and travel allowances, uncanny accuracy and convenience of operation, the sensitive and versatile Hamilton Varimatic will win your confidence in one day of operation.

Write for descriptive literature containing specifications and prices. Address Department D.

THE *Hamilton* TOOL COMPANY

SUPER SENSITIVE DRILLING MACHINES · TAPPING MACHINES · PORTELVATORS

NINTH STREET AT HANOVER · HAMILTON · OHIO · U·S·A

...NO STONE UNTURNED

Everything is being done . . . Floor space added—more machines—more equipment now in use . . . 100% capacity day and night . . . every member of the Abbott organization is "in high gear" . . . Yes, we're leaving no stone unturned to keep Abbott Bearing Balls rolling to you.

ROLL ON **ABBOTT** *Bearing* **BALLS**

THE ABBOTT BALL COMPANY · HARTFORD 10 CONN. U.S.A.

Buying A Recently Built Surplus BAKER?

Current models are 150—217—422 31½A—26HO—36HO—30HO Inverted

HERE, a BAKER 150 Universal Quick Change Type Geared-feed heavy duty Drill, being used in the production of air craft engine parts . . . handling the job with an efficiency typical of every machine BAKER has manufactured. And, as is the case with all BAKER Machines, this unit can be re-tooled quickly and economically to handle a variety of other jobs as conditions require.

. . . then here is BAKER's *plan to assure good service!*

• If you are contemplating the purchase of a surplus BAKER Single or Multiple Spindle Drilling Machines, built 1940-45, check with a Baker representative at the time of your purchase. He will be glad to furnish the date of original purchase, the correct model designation, and information as to the equipment originally included with the machine. In addition, we will co-operate to the fullest extent on any problems of reconversion, directing our efforts and engineering facilities toward gaining for you the finest possible service from whatever BAKER Machine you purchase. Check the list of BAKER Representatives shown here and contact the one nearest you. He'll welcome the opportunity to be of service to you.

Anderson Machine Tool Co., St. Paul
Buckner-Weatherby Co., Seattle, Washington
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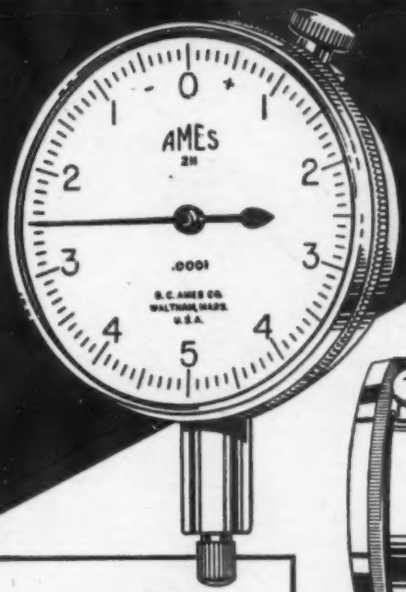

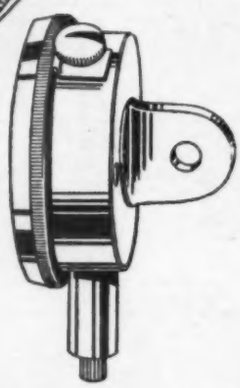

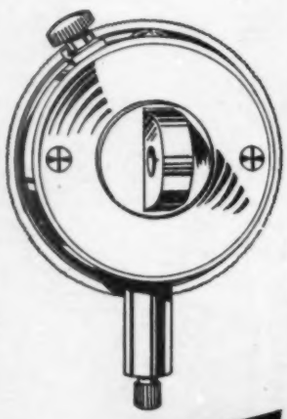

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Bezel, machined from brass tubing, is held to case by a wire which is easy to snap out and replace.

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Case is machined from a thick section bronze forging, as is the back, and both are polished and chromium plated.

Large screws are used throughout.

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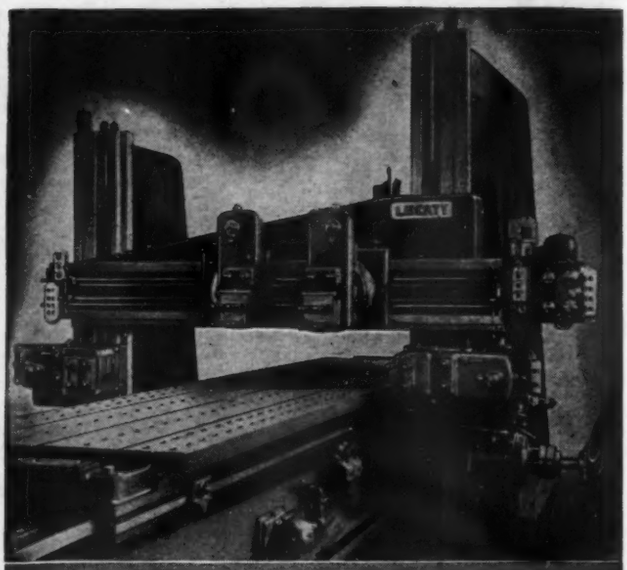

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By M. C. SLACK
Vice President Frost Paint and Oil Corp.

Rust, generally speaking, is the result of the combining of the oxygen of the air, humidity, and the exposed, unprotected surfaces of commercial ferrous metals. Rusting can be called a process of oxidation.

Fire, as we generally think of it, is the process of combining one chemical element with another, when reduced to gaseous condition, whereby heat and flame are produced. Fire can be called a process of oxidation.

Rusting can therefore be termed a fire. Unprotected and exposed ferrous metals always rust when in storage or in transit. The risk is absolute. The loss is certain—staggering.

As a matter of course and good judgment, premiums are paid on insurance policies to cover every conceivable and insurable risk. Many policies expire without a loss. Yet, no business man would consider the lapse of a single day in his fire insurance protection.

Rust is an absolute risk and loss. It always occurs on unprotected ferrous metals.

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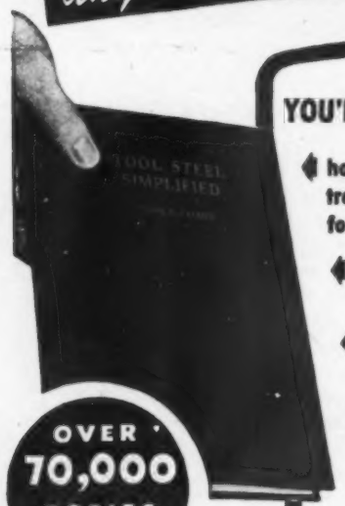

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Vice-President of
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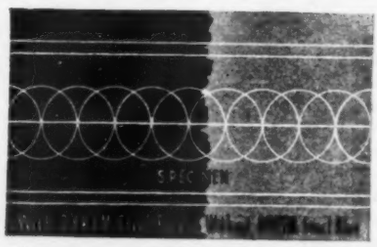

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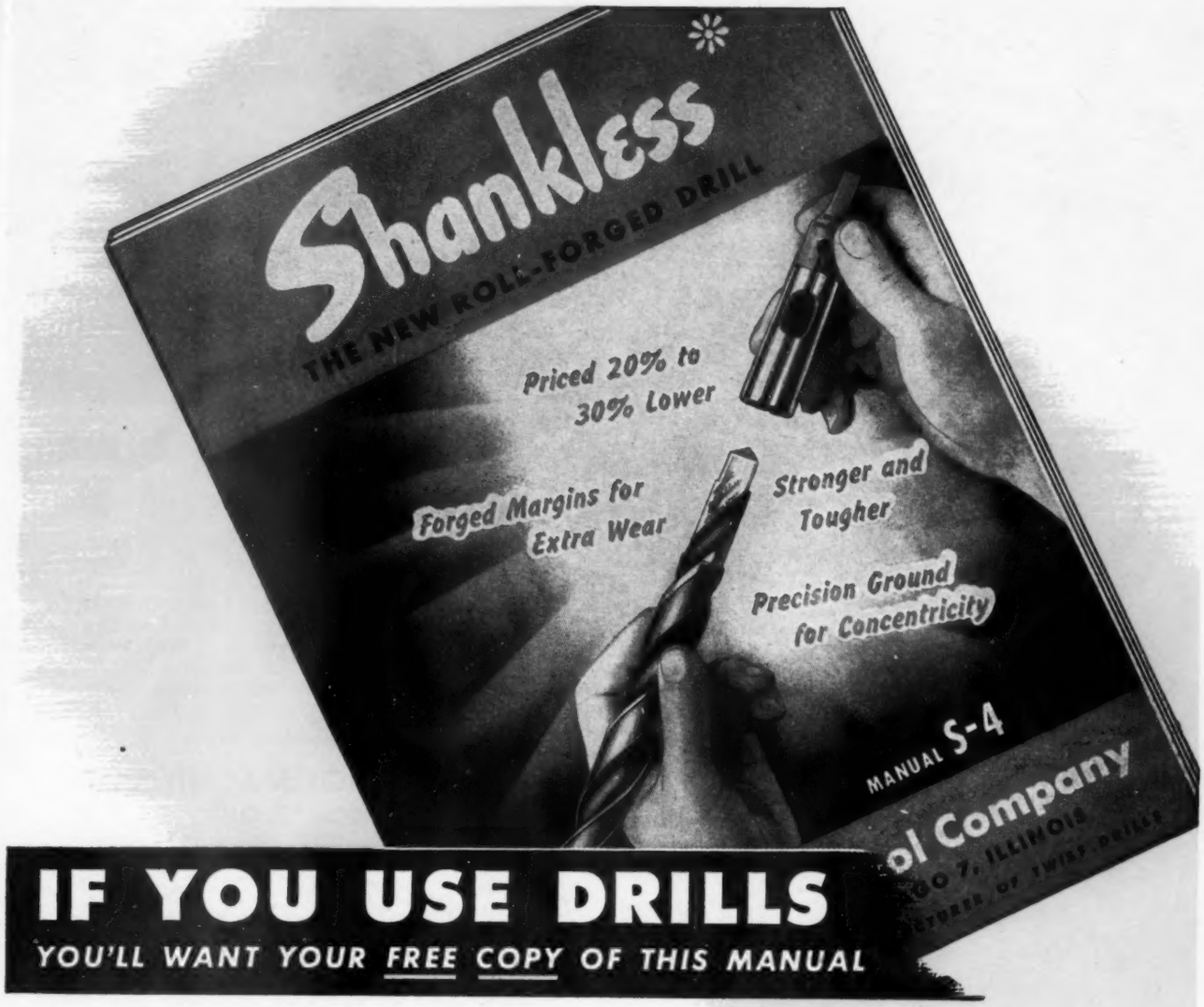

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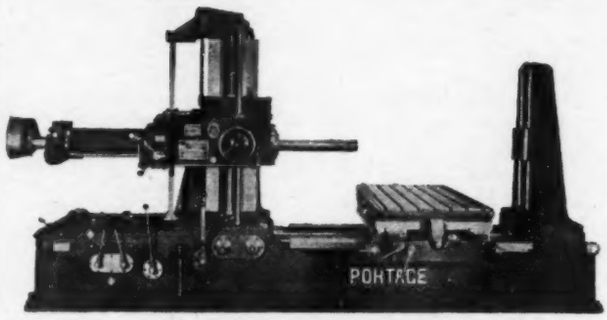

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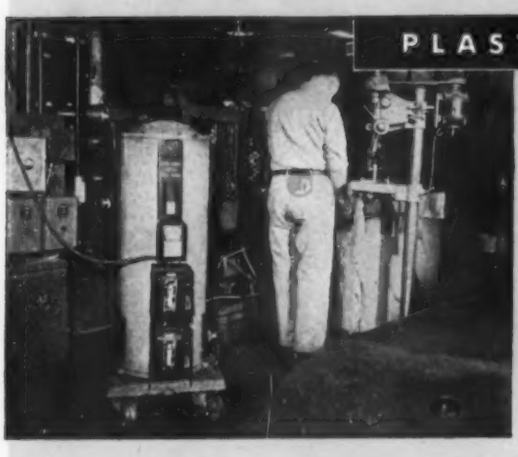
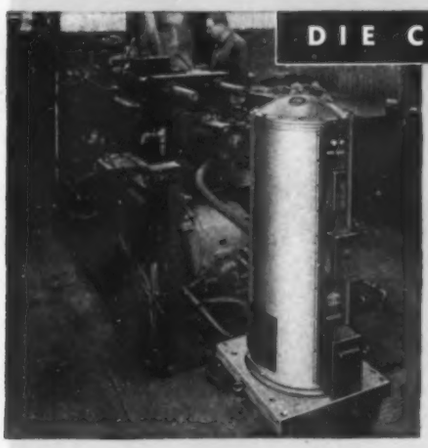


PLASTICS

At L. H. Sheppard Sons Co., Elyria, Ohio, a Honan-Crane Purifier mounted on a dolly is used to keep all contamination out of the oil in Reed Prentice plastic injection molding machines. The mobile Purifier is used on a regular schedule of purification to prevent the formation or accumulation of any dirt or contamination in the hydraulic oil or system. This regular schedule of purification protects pumps, valves and controls and allows continuous operation of the machines with a minimum of maintenance and repairs. This purifier has been in operation for more than two years and there has been no pump or valve trouble in that period of operation.

Purification of hydraulic oils in plastic machines may be performed while machines are in operation by a mobile Purifier or by direct connected individual Purifiers.



DIE CASTING

At Pressure Castings, Inc., Cleveland, Ohio, a Honan-Crane Purifier mounted on a dolly is used to purify the oil in a battery of die casting machines. Purifier is moved from machine to machine on a regular schedule of purification that furnishes complete protection against dirt or contamination which might otherwise get into pumps, valves and other hydraulic controls.

Stanley Bolinski, maintenance supervisor for Pressure Castings, estimates that the use of this Honan-Crane Purifier has reduced maintenance on pumps and hydraulic controls by as much as 50%.

Purification is performed while press is in operation.

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At Cleveland Screw Products a central oil purification system using a Honan-Crane Oil Purifier furnishes a constant supply of clean oil to 17 thread grinding machines.

Operator has only to turn a valve to fill machine with oil

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Cost of purification is very low

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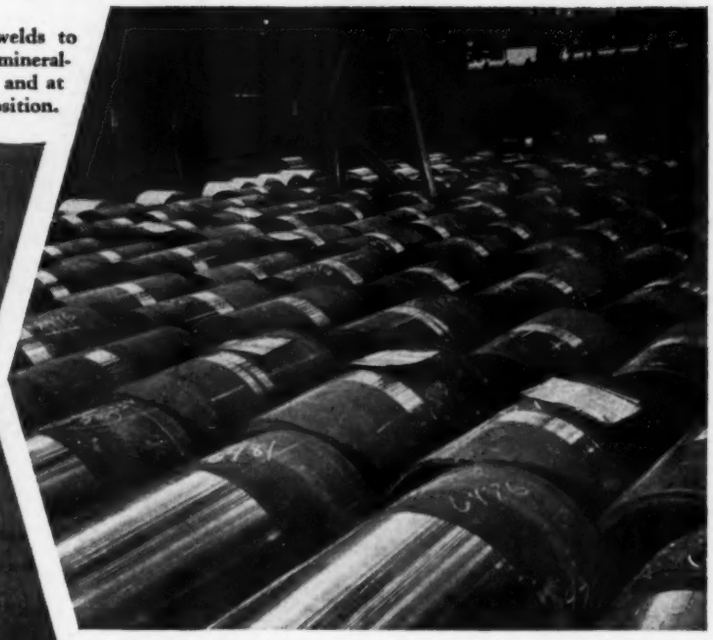

1946 The development of X-ray inspection, further SMITHway developments in mineral coatings for electrodes, and the SMITHway mastery of welding preparation and techniques, have made possible more than *one mile a day* of X-ray quality welding on torpedo airflasks in A. O. Smith plants.

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- Eliminates Mixing-Hazards
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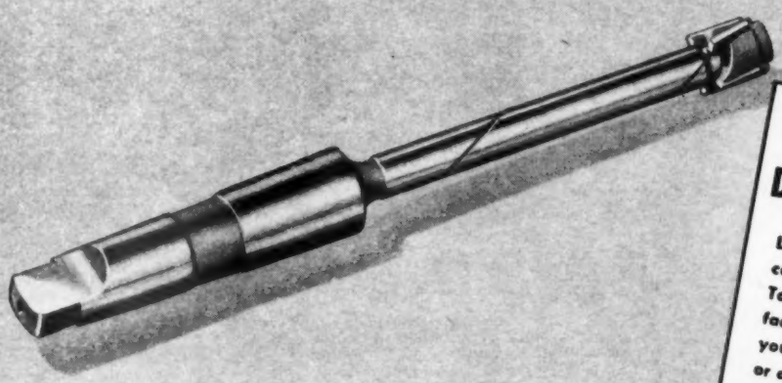

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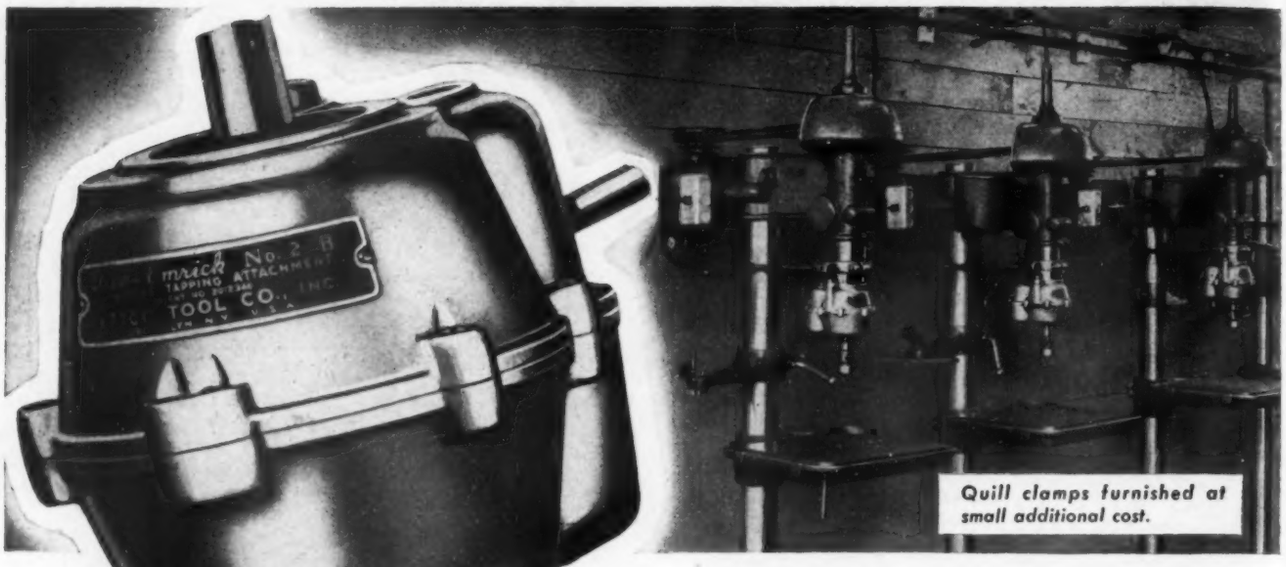

Quill clamps furnished at small additional cost.

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MAKE IDLE DRILL PRESSES EARN THEIR KEEP . . .

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Ettco-Emrick TAPPING ATTACHMENTS

It's not necessary to let your drill presses stand idle while waiting for the next drilling operation. Make them do double duty with Ettco-Emrick Tapping Attachments. No alteration of the presses is necessary. Just clamp one of these attachments to the spindle of the drill press and you are ready to turn out fast and accurate work to satisfy all commercial requirements in the range of No. 0 to 1" taps.

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Super-Sensitive friction clutch
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Tap idles in cutting direction
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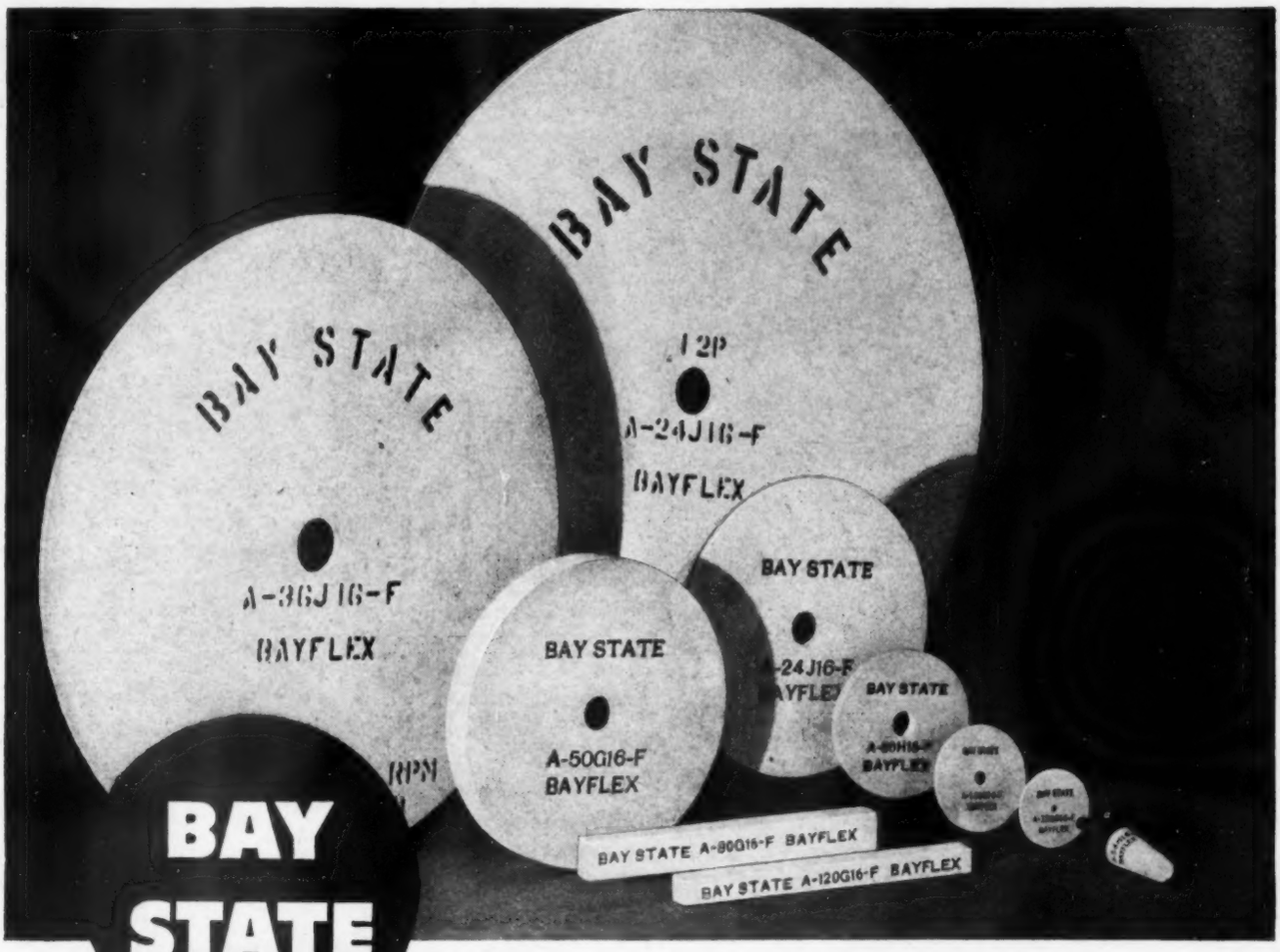

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BEVERLY HILLS, CALIFORNIA

MEN WHO KNOW...

...PREFER...
KESTER Cored SOLDERS
for work that MUST be right!

- Safeguard the performance of the equipment you build with the help of Kester Cored Solders!
- The superior quality of Kester alloys enables them to stand up permanently under vibration, shock, bending and the contraction and expansion of temperature extremes. Self-contained fluxes are positive-acting and do not disintegrate or lose fluxing power.
- The patented plastic rosin flux in Kester Rosin-Core Solder will not cause corrosion at electrical terminals, or injure insulating material. Terminal resistance is eliminated when connections are protected with Kester Rosin-Core Solder.
- For general soldering use Kester Acid-Core Solder for clean, permanent results.
- Insist on Kester, whatever the soldering job. Kester solder specialists, backed by 47 years of laboratory research and practical experience, will gladly assist you with any solder question. No obligation, of course.

KESTER SOLDER COMPANY
4223 Wrightwood Avenue, Chicago 39, Ill.
Eastern Plant: Newark, N. J.
Canadian Plant: Brantford, Ont.

KESTER
Cored Solders
STANDARD FOR INDUSTRY

NEW AND IMPROVED
DU PONT SOLVENT
for VAPOR DEGREASING!

AVAILABLE NATIONALLY THROUGH DISTRIBUTORS!

Under various trade names, Du Pont Trichlorethylene and Perchlorethylene solvents for metal cleaning have served American industry successfully for many years. If you have used vapor degreasing solvents in your plant, no doubt you have used these solvents made by Du Pont.

NOW Du Pont has developed *new and improved* Trichlorethylene and Perchlorethylene—the same fine solvents, but BETTER THAN EVER, thanks to various technical improvements. These are the best Vapor Degreasing solvents we've ever made—the best we know how to make. Use them with complete confidence and assurance for all metal degreasing work. We believe they'll serve you *better!*

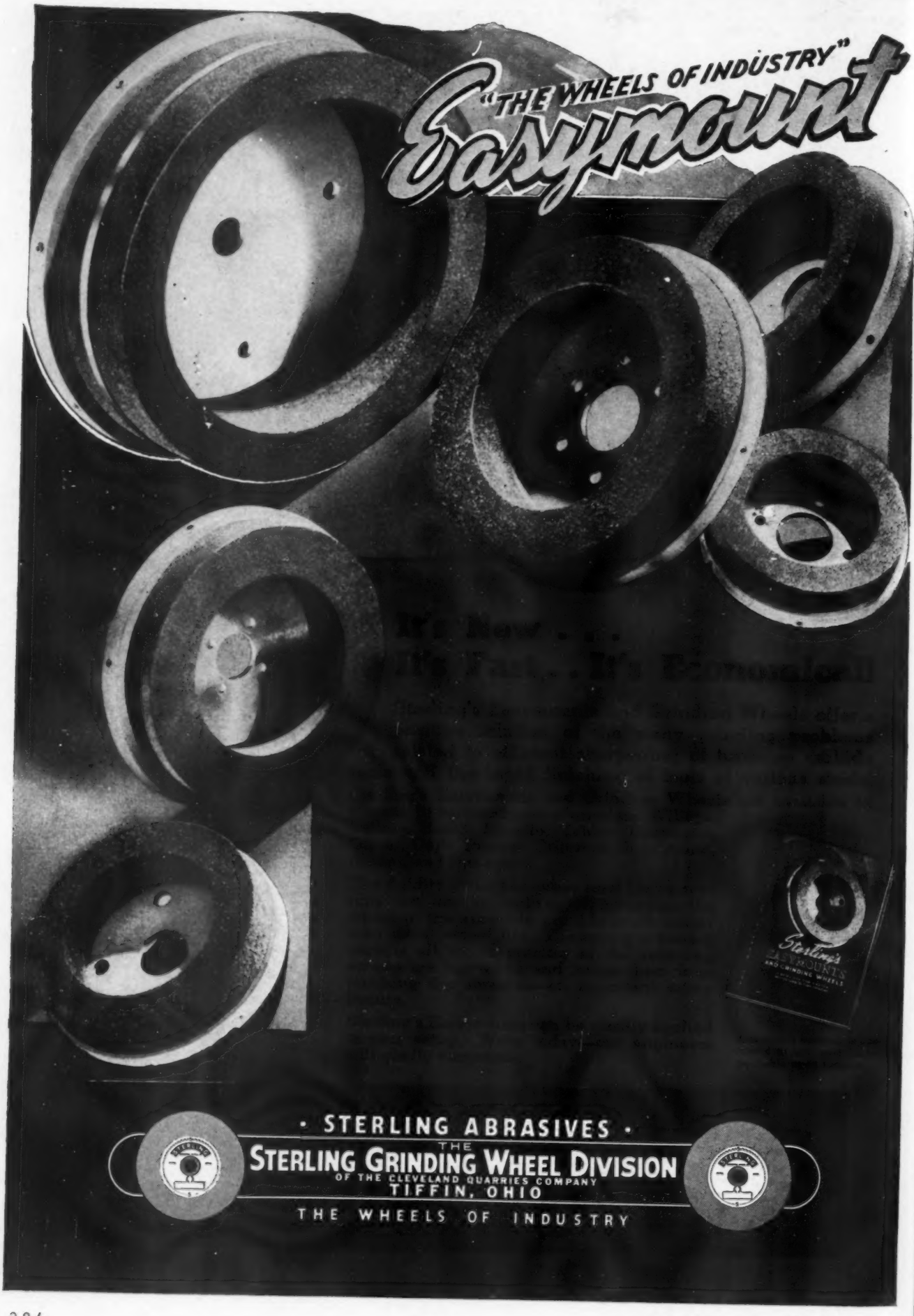
NEXT TIME you specify solvents for Vapor Degreasing, specify *new and improved* Du Pont Trichlorethylene and Perchlorethylene—available nationally through distributors as "Triclene" D and "Perclene" and under other trade names. Look to these solvents for superior work, maximum savings! Send today for your copy of our new free book, "Metal Degreasing—Standard Practices."

E. I. du Pont de Nemours & Co. (Inc.)
Electrochemicals Department
WILMINGTON 98, DELAWARE

BETTER THINGS FOR BETTER LIVING...*THROUGH CHEMISTRY*

DU PONT

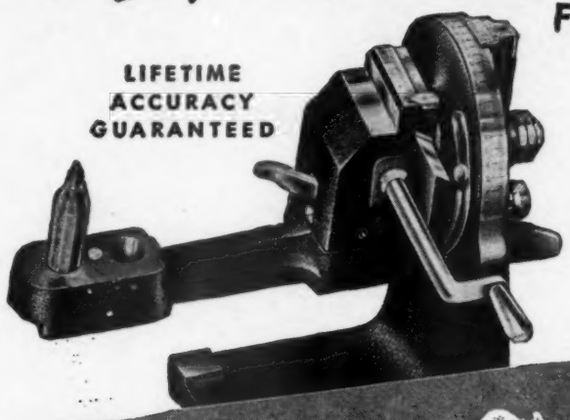
DU PONT SOLVENTS


"THE WHEELS OF INDUSTRY"
Easymount
Sterling's
EASYMOUNTS
AND GRINDING WHEELS
· STERLING ABRASIVES ·
THE
STERLING GRINDING WHEEL DIVISION
OF THE CLEVELAND QUARRIES COMPANY
TIFFIN, OHIO
THE WHEELS OF INDUSTRY

Bley CONTOUR DRESSER

FOR SHAPING GRINDING WHEELS

LIFETIME ACCURACY GUARANTEED



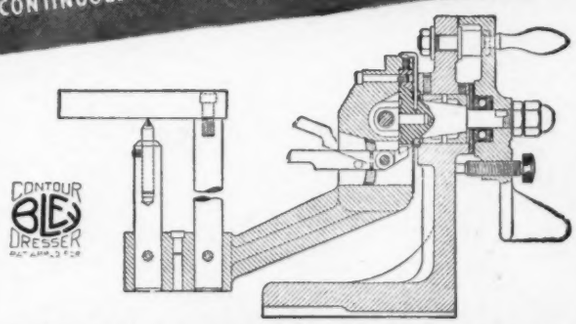
FOR ABSOLUTE PRECISION IN THE FORMING OF GRINDING WHEELS: ANGLES, RADII AND THEIR COMBINATIONS AND PERFECT BLENDING OF RADII WITH TANGENTS . . .

TYPICAL FORMS MADE ON A SURFACE GRINDER, WITH BLEY CONTOUR DRESSER WITH ARROWED LINES SHOWING EXTENT OF CONTINUOUS TRAVEL WITHOUT A CHANGE OF SET-UP.

The unparalleled accuracy of the Bley Contour Dresser is assured by these exclusive PATENTED features: (A) The sectional taper bearing, controlling all motion for radius work. (B) The lock-gib-adjustment, provided with floating screw feed for all angular passes. And (C) The center lock lever which centers the carriage for perfect tangent blending. All are adjustable not only to .0001" but to "no play." Consider these advantages carefully—then consider these other outstanding features:

1. Screw feed for angular passes — the only accurate control (no rack and pinion—no swiveling).
2. Fast, simplest to set up—easily maneuverable, sturdy, chatterless and dustproof.
3. Every functional part has compensating adjustment for lifetime accuracy.
4. Capacity: 3" male and 3" female radii up to 14" wheel, 2" angular travel.
5. Shapes wheel at its working surface.

A UNIQUE RECONVERSION VALUE OUT-PERFORMING OLD-STYLE MACHINES COSTING 3 TIMES AS MUCH



BLEY CONTOUR DRESSER

WITH 9 DIAMOND TOOLS

90° GOLCONE shaped point	$ 3.50
60° GOLCONE shaped point	4.00
CRYSTAL point	3.50
ELONGATED natural point	5.00
Rattail Tools For Semi-Circular Radii	
1/4" Rattail, radii from 0.250"	7.50
1/8" Rattail, radii from 0.125"	7.50
1/16" Rattail, radii from 0.060"	5.00
5/32" Rattail, radii from 0.040"	7.25
3/16" Rattail, radii from 0.030"	8.50
	$51.75

6 EXTENSION SLEEVES and
1 RATTAIL TOOL ATTACHMENT
ALL FITTED IN FINE HINGED WOOD INSTRUMENT CASE

PRICED COMPLETE

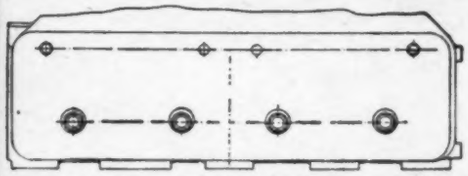
$207.50

GOLCONDA DIAMOND PRODUCTS CORP.

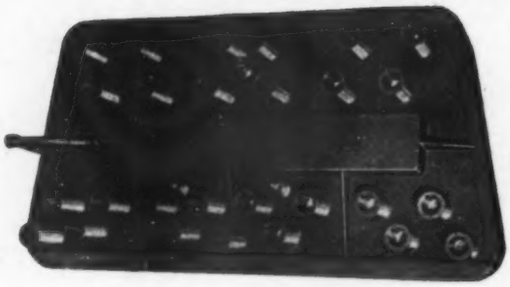
3414 NORTH KNOX AVENUE • CHICAGO 41, ILLINOIS

Distributors: A few domestic and foreign territories still available

Special HOEFER Unit
• • DRILLS AND REAMS THREE DIFFERENT CYLINDER HEAD PARTS



• Typical Diesel Cylinder Head layout drilled and reamed 51 feet per minute, 286 r.p.m., .010-inch feed, 1½ travel—requires only 31 seconds total time.



★ This interesting 27-spindle full anti-friction head, with three groups of spindles is capable of being driven in individual groups by engaging drive through one of the three gear shift buttons shown. Forced cascaded lubrication provided in head which was driven by vertical hydraulic feed driller. This head in combination with the fixture we furnished drills the bolt holes in three different sizes of Diesel engine cylinder heads.

This Hoefer Multiple Spindle Head is an example of the ability of Hoefer engineers to meet the most unusual hole drilling requirements giving you a simplified method and one that ensures time and cost savings. Hoefer Heads are attachable to your own drill presses or turret lathes. Among the benefits are savings in floor space as well as the cost of new machinery. Having designed thousands of heads our engineers can easily develop a multiple drilling head to fully meet your specific needs. Write, telling us about your job.

Hoefer's Whole Business is Holes • • • •

HOEFER MFG. CO. *Freeport, Ill.*

USE

Fluid-motion

for modern form-dressing

ONE SETTING HANDLE CONTINUOUS MOTION

J & S Radil & Angle Dressers in the "Fluid-Motion" series are among the finest precision dressing instruments procurable. . . . regardless of cost. There is a standard model to fit most form-dressing requirements.

FEATURES

Fluid-motion dressing
.0001" accuracy
Automatic centering
7" & 14" wheel capacities
Large range yet compact
Chatterless and dustproof

J. & S. TOOL CO.

477 MAIN STREET
EAST ORANGE 1, N. J.

MICROMETER ADJUSTMENT

on side milling cutters and gang milling setups with Dayton Rogers Micrometer Adjustable Spacing Collars

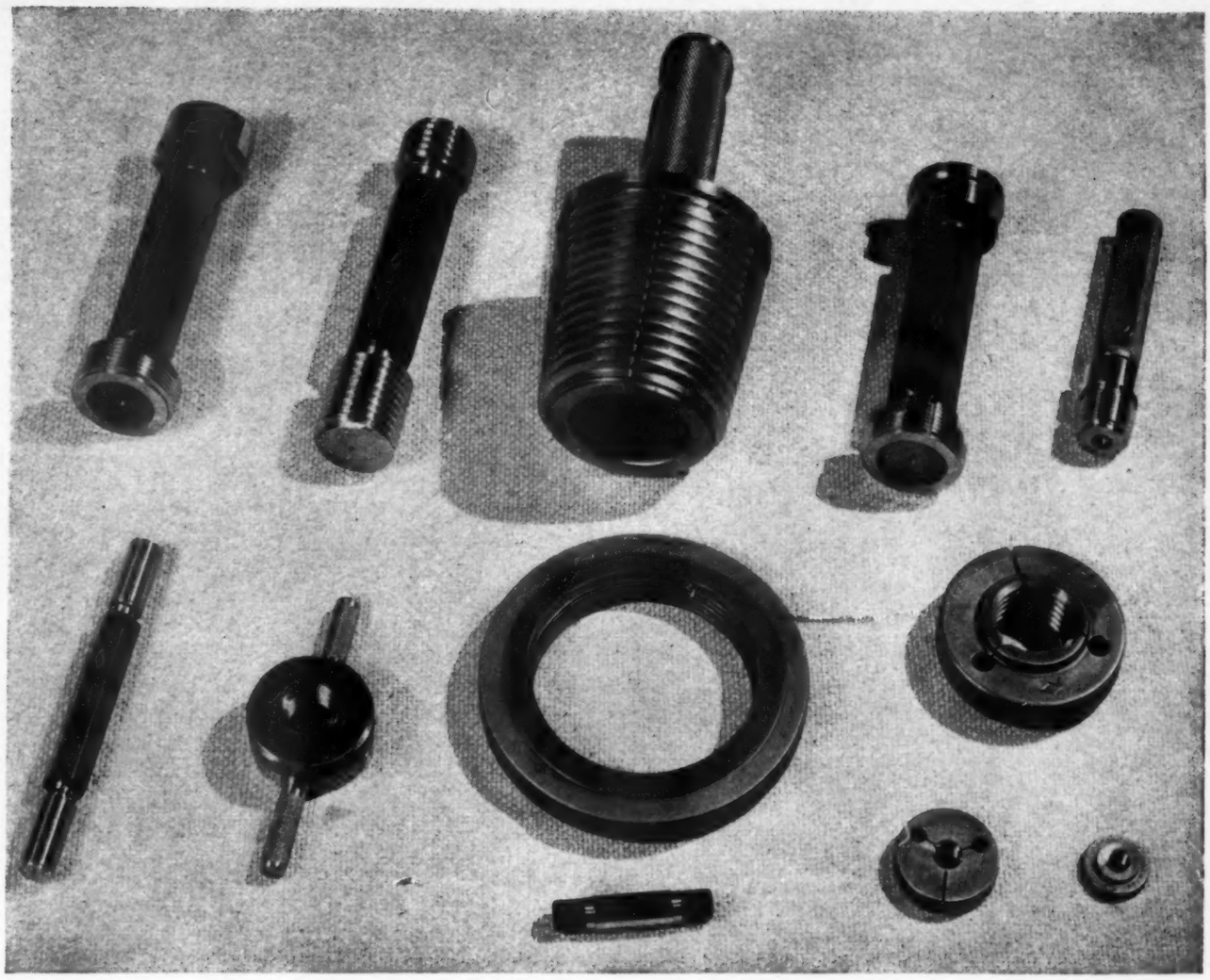
You can make an adjustment QUICKLY — ACCURATELY on all milling machine setups with these collars by merely loosening the cutter arbor nut and making an adjustment as required. Graduated in thousandths, an adjustment of .0005" can be made very readily by visual calibration.

Made in twelve standard sizes from ⅞" to 2" for immediate shipment. Each collar furnished with spanner wrench for making adjustments.

Write for Bulletin No. 128-1.

DAYTON ROGERS MANUFACTURING CO.

MINNEAPOLIS 7 MINNESOTA



When you want Gages *Quick!*

Here at Pipe Machinery, we maintain large stocks of standard plug, ring and thread gages—all of established PM standards of accuracy and finish.

When emergencies arise—when you need gages in a hurry—just write, wire or phone us. Often we are able to give you one-day service on shipments.

Of course we make special gages, too—on receipt of your specifications, will gladly quote prices and delivery dates.

Two things you can always depend upon when your gages carry the PM trade mark—original accuracy of dimension and extra good finish for long wear.

PM CO

ARMY NAVY

The PIPE MACHINERY COMPANY Cleveland, O.

PROBLEM: Manufacturer of hydraulic pressure system pumps for 3000-psi service sought a hydraulic oil that (1) would resist oxidation at the 135° F. pump-operating temperature; (2) could be safely used for run-in test purposes; and (3) would have inherent rust-preventive qualities so it could be used as a "shipping" oil.

SOLUTION: When the Shell Lubrication Engineer studied the problem, he recommended a Shell Tellus Oil. The specifications of this oil satisfied the pump maker on points (1) and (2), but he was skeptical of the rust-preventive qualities. A "storage" test was made, and, when Tellus-filled pumps were inspected, no sign of rusting was found. Convinced, the pump maker now uses Shell Tellus Oil exclusively.

CONCLUSION: It pays to consult the Shell Lubrication Engineer, regardless of the nature or size of your lubricating problem. Write for informative literature on Shell Hydraulic Oils. Shell Oil Company, Incorporated, 50 West 50th Street, New York 20, New York; or 100 Bush Street, San Francisco 6, California.

SHELL HYDRAULIC OILS

SHELL

Gorham HIGH SPEED STEEL TOOL BITS

. . . wisest choice for NEW jobs too!

New products, new applications, new markets appear every day—each presenting new production problems. Half the battle in licking these problems is selecting the right TOOLS for the job. And the tool best suited to a NEW job is one that has proved its worth on OLD jobs. • • • The name GORHAM is gilt-edged insurance for quality performance. GORHAM High Speed Steel Tool Bits have established an enviable record.

On some of the toughest production jobs of the war, they came through with flying colors. What better recommendation for your *postwar* plans? • • • *You can't go wrong with GORHAM!*

Catalog sent upon request

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1. GORHAM Standard
for Broad Commercial Use

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2. GORHAM M-40-B
for Heavy Cuts in Hard Material

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3. GORHAM Gormet
for More Abrasive Materials

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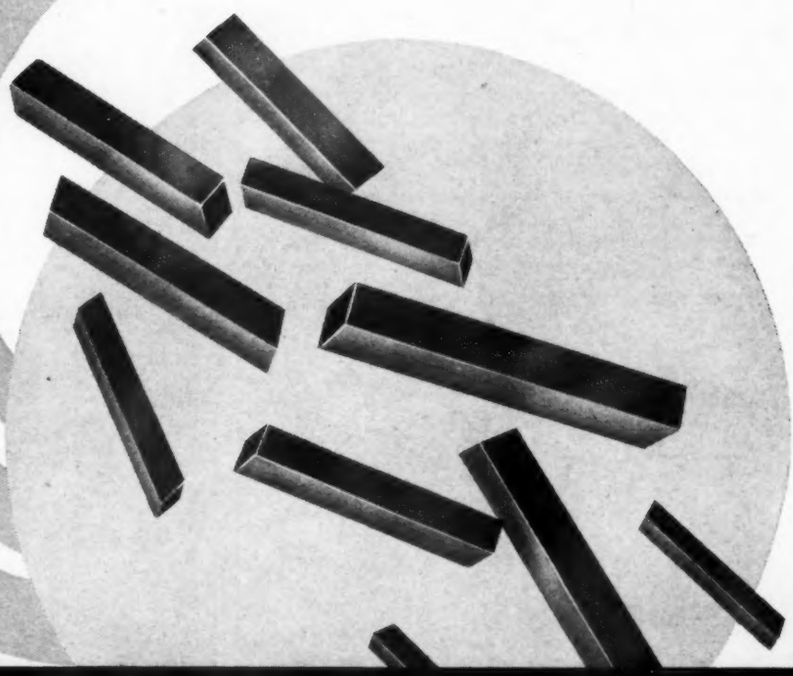

GORHAM TOOL COMPANY

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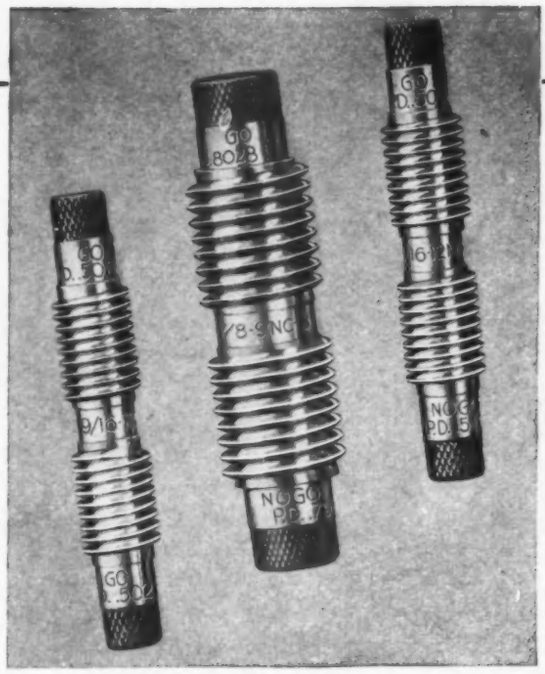

THRED-MASTER

Saves TIME AND EQUIPMENT

Each THRED-MASTER consists of a go and no-go section combined in a progressive type gage with knurled handles.

Being round, the THRED-MASTER presents an infinite number of measuring contact points which means greater gaging-life. THRED-MASTERS are made to "Master" gage accuracy and conform to N.S.T.C. standards.

They are easy to use:—Pick out the THRED-MASTER and corresponding measuring wires of the proper size. Set up your amplifier directly by the three wire measuring system.

These measuring standards are ideal for setting up amplifiers (either visual or electric) and for accurately adjusting roll thread snap gages.

Write for price and delivery.

REPUBLIC GAGE

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ERRINGTON MECHANICAL LABORATORY

STAPLETON, STATEN ISLAND 4, N. Y.

MULTIPLE HEADS

Super-Sensitive Fixed Center Multiple Drilling Heads
Fixed-Center Auto-Reverse Multiple Tapping Heads
All Parts Fully Enclosed to Insure Pressure Lubrication and Rigid Support of Adjustable Spindles
ADJUSTABLE MULTIPLE SPINDLE DRILLING HEAD

FOR CLEANER WHEELS

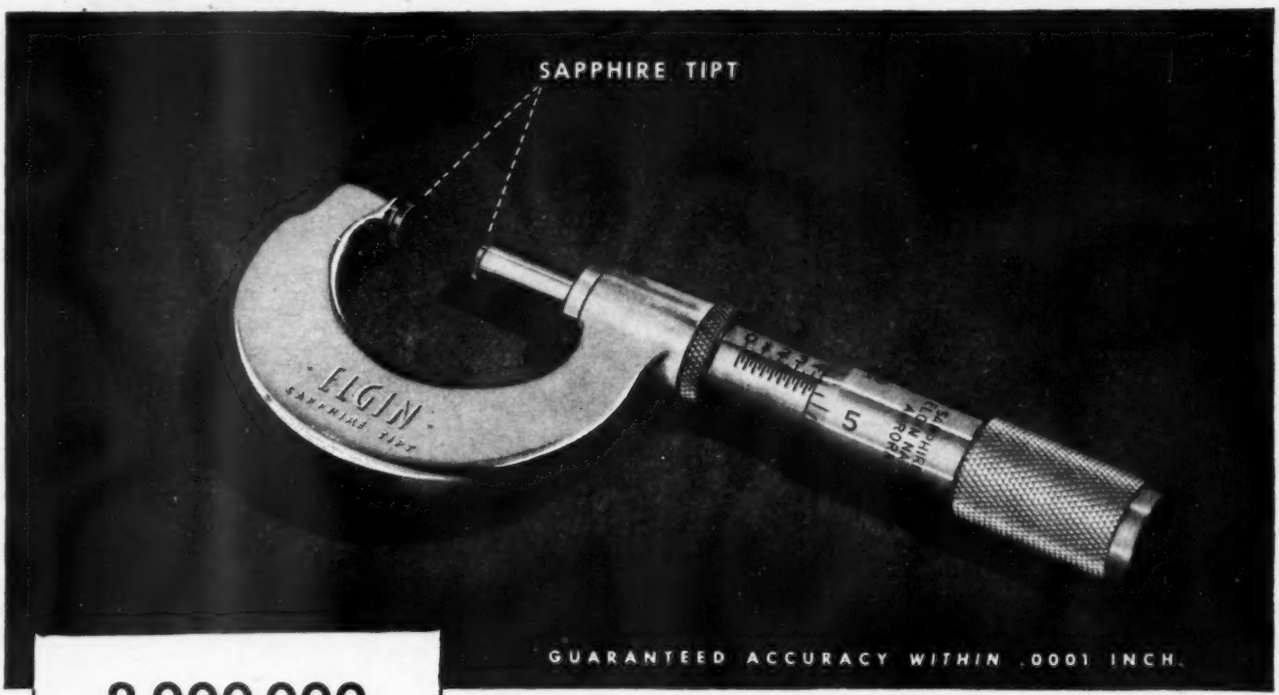
ECONOMY

Grinding and Cutting Oils and Lubricants for Every Metal-Working Purpose

THE WHITE & BAGLEY COMPANY

WORCESTER, MASSACHUSETTS

Now...Elgin *Sapphire* Tipt MICROMETERS



2,000,000
PRODUCTION GAGINGS

The original Elgin Sapphire Tipt Micrometer is in use without wear after more than 2,000,000 gagings in a drill plant.

READY FOR SHIPMENT NOW. 1"—$25, 2"—$26.50, 3"—$28. Discount on quantities. Elgin Sapphire Gages have been outwearing steel as much as 7,000 to 1. Now Elgin Sapphire has been mounted on the anvil and spindle of a superbly engineered lightweight micrometer. Here is a micrometer to give accuracy you can always be sure of . . . and to save you man-hours, money, materials.

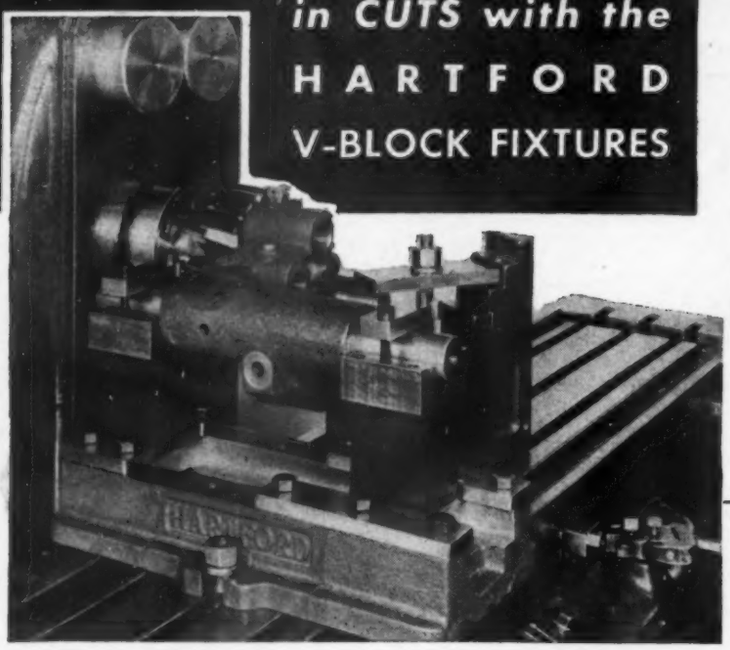
FEATURES OF THE ELGIN MICROMETER
- Sapphire Tipt Anvil and Spindle
- Adjustable Spindle Bushing
- Hollow, Lightweight Frame of Stabilized Steel
- Tool Steel Hardened-Ground Spindle Thread
- Positive Lock Nut
- 1/10 Thousandths Graduations (by precision graduating machine)

SAPPHIRE PRODUCTS DIVISION
Elgin National Watch Company, 932 Benton Street, Aurora, Illinois

REPRESENTATIVES IN CITIES FROM COAST TO COAST

ELGIN
Sapphire Gages
DIMENSIONAL FIDELITY IN GAGING OPERATIONS

ASSURING SQUARENESS in CUTS with the HARTFORD V-BLOCK FIXTURES



Many busy plants have availed themselves of the time savings and accurate set up assured by the Hartford V-Block Fixture. Milling, drilling, boring and inspection have been simplified by the use of this fixture which provides a practical and convenient method of locating and holding irregular work of all kinds.

This device consists of a semi-steel base accurately machined and scraped. Cross keyways and ample clamping facilities are provided for holding to machine table. Clamps for positioning V-blocks in the base provide for adjustment. A set of hardened and ground V-blocks with clamps for holding test bars or arbors in place are also included with this equipment.

Write today for further details.

Showing a milling cut being taken to square up end of casting. As this cut is taken from the original setting, squareness to holes is assured. Work is held in V-Block Fixture.

The HARTFORD SPECIAL MACHINERY CO. HARTFORD 5, CONN.

Makers of the famous HARTFORD SUPER-SPACER

GRINDING WHEEL DRESSER

Desmond Cutter

Desmond Hex Dresser

We manufacture a complete line of Dressers and Cutters. Write for copy of catalog "A".

DESMOND-STEPHAN MFG. CO.
URBANA, OHIO
Canadian D-S Mfg. Co., Hamilton, Ont.

CRAFTS

Consistent Quality

GAGES AND TOOLS

ARTHUR A. CRAFTS COMPANY, INC.

603 Newbury Street
at Kenmore Sq. BOSTON
DETROIT - CHICAGO

YELLOW HEAD GRINDING WHEEL DRESSERS

Faster Dressing without overheating

A Magazine for dry graphite
B Ducts to bearings
C Spindle bearings
D Safety Head

Self-Lubricating

For more than 20 years YELLOW HEAD "Self-Lubricating" Dressers have increased cutting speed of grinding wheels while decreasing dresser and cutter maintenance.

When using the YELLOW HEAD a thin film of graphite is sucked from the magazine handle, increasing life and preventing overheating. Dry graphite guarantees free, greaseless lubrication. Economical, safe. Selection of cutting heads available. "Yellow Head" also comes in plain type, one piece handle and head.

CITY MACHINE COMPANY, PIQUA, OHIO

YELLOW HEAD
Write for complete details, prices

Bunting Cast Bronze Bearings lend themselves readily to simple, clean design—only a straight shaft, a bearing of finely finished bearing bronze, a housing surrounding it and the oil film to insulate against noise and wear. The Bunting Brass & Bronze Company, Toledo 9, Ohio. Branches in principal cities.

Bunting

BRONZE BEARINGS ☆ BUSHINGS ☆ PRECISION BRONZE BARS

38

You Can Make Beautiful ... Like This

At Low Cost...

By automatically welding units like these

with FEDERAL RESISTANCE WELDERS like this

Nearly three hundred different "steel ware" items are processed, in one or more stages, on the Federal PATM-3 250 KVA welder shown at right, and a Federal PA-2 150 KVA machine with which it is teamed, at the plant of General Steel Wares Ltd., Toronto. Some fifty sets of dies, designed to be usable in hundreds of combinations, help to solve this company's problem of manufacturing an all-embracing variety of quality metal merchandise in "semi-mass" lots.

For nearly ten years these same Federal welders have projection welded spouts on percolators, bail tabs on teakettles, handles on double boilers and roasters, have spot welded many shapes, and performed hundreds of other low-cost operations. Illustrations of a few regular items at left only partially indicate the wide vari-

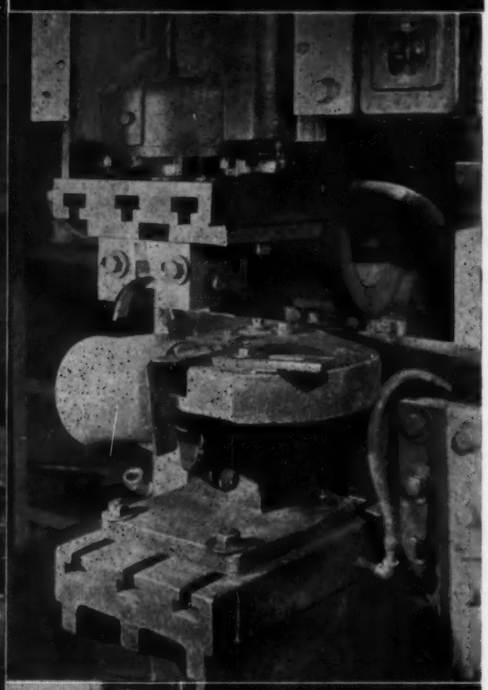
ALL PICTURES
Courtesy General Steel Wares Ltd.
Toronto, Ont.

THE Federal MACHINE

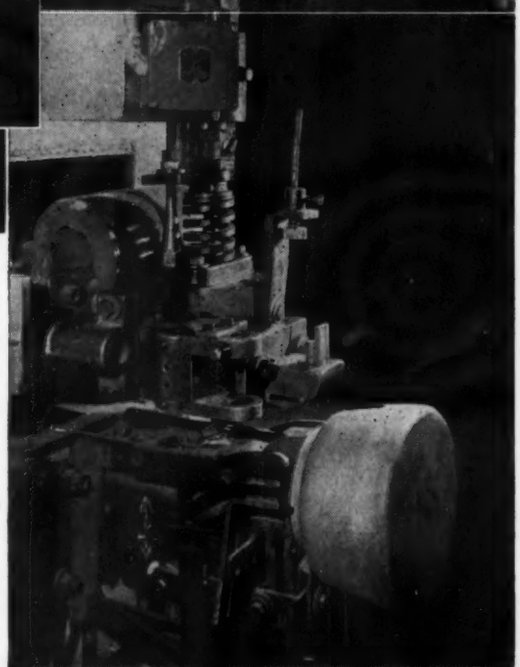
SUBSIDIARIES
Acme and Adams Co., Cleveland—SPECIAL HIGH PRECISION MACHINES
The Ajax Co., Inc., Warren—HEAVY WELDMENT-HEAVY MACHINERY

Durable Steelware

This fixture can be adjusted to fit more than one size of handle. The Federal resilient head, combined with air-operation, assures smooth operation, fast follow-up.



This Federal PATM-3 Press Tube Welder is projection welding handles on percolators at the rate of about 500 per hour. (See fixture upper right). Previous operation, on a companion Federal, attached the spouts.



ety of shapes these welders have handled continuously since 1937.

Whether you make houseware or houses, toys or tractors, you are today faced with certain increasing costs . . . It is important that you investigate possible applications of Federal Resistance Welders to assure utmost efficiency in YOUR processing.

Federal makes every variety of resistance welder . . . Spot, projection, seam, roll spot, flash or portable gun types . . . Federal engineers also design machinery combining the features needed to fit special production. To attain maximum metal fabricating efficiency, employ Resistance Welding. To get the most from Resistance Welding . . . be sure it's by

Parts of this fixture are adaptable to other operations, other shapes. Here, tabs for tea-kettle bail are projection welded to body. Change-over to setup for attaching spouts takes but a few minutes.

Federal

AND WELDER COMPANY

230 DANA STREET • WARREN, OHIO

The Ancients Knew the Value of **GOOD MARKING**

History records our ancestors' appreciation of the value of individual marking to establish the authenticity of all personal and business transactions. The mark of a signet ring impressed in sealing wax was usually employed for protection of their good name against fraudulent use on letters and papers.

Trade Marks have been used by business houses for similar purposes for many years. To the consumer they are a recognized guarantee of the quality of the product and the integrity of the maker. For nearly a century Jas. H. Matthews & Co. has specialized in the design and manufacture of marking devices. If you have a marking problem, we will be glad to help find a solution. *Any product worth marking is worth marking well.*

JAS. H. MATTHEWS & CO.

3956 FORBES STREET PITTSBURGH 13, PA.

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District Sales Offices: Cleveland, Cincinnati, Birmingham

"It's Fast and Easy!"
WYCO HY-SPEED SAW
Fits any ¼" electric drill, air drill or flexible shaft.
Speedy! Accurate! Powerful! Saws and files metals, woods, plastics. Chucks in drill chuck or collet. Uses ordinary hack saw blades and standard ¼"" shank machine files. Easily used in difficult places.
● All rotating parts ball bearing, running in oil.
● No gears. No cams. Always smooth-running.
● Square plunger with take-up for wear. All wearing parts heat treated.
● Saw chuck holds firmly, aligns saw perfectly.
● Complete with extra saw blade and ¼" round machine file $35
Send for Catalog on Complete Line of WYCO Tools and Flexible Shaft Equipment
Square Saw Plunger (Perfectly guided)
Magnesium Body-light weight
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Alloy-Steel Spindle—heat treated with Ball Bearings
WYZENBEEK & STAFF, Inc.
W. HUBBARD ST. • CHICAGO 22, ILLINOIS

JKS DIAMOND TOOLS for FORM DRESSING
A broad line of JKS Form Dressing Tools has been developed to meet the need in recent years for form dressing abrasive wheels. Here are a few types for forming a wide variety of shapes.
BLADE TOOLS — For production form dressing; all sizes of wheels.
CHISEL TOOLS — For toolroom use where minute radii are required. Made to specified included angles.
CONE-SHAPED TOOLS — For forming small wheels. Made to standard angles of 90°, 75°, and 60°.
PYRAMID DIAMOND TOOLS—For forming larger wheels where a radius of 1/32" or larger is required.
J. K. SMIT & SONS, Inc.
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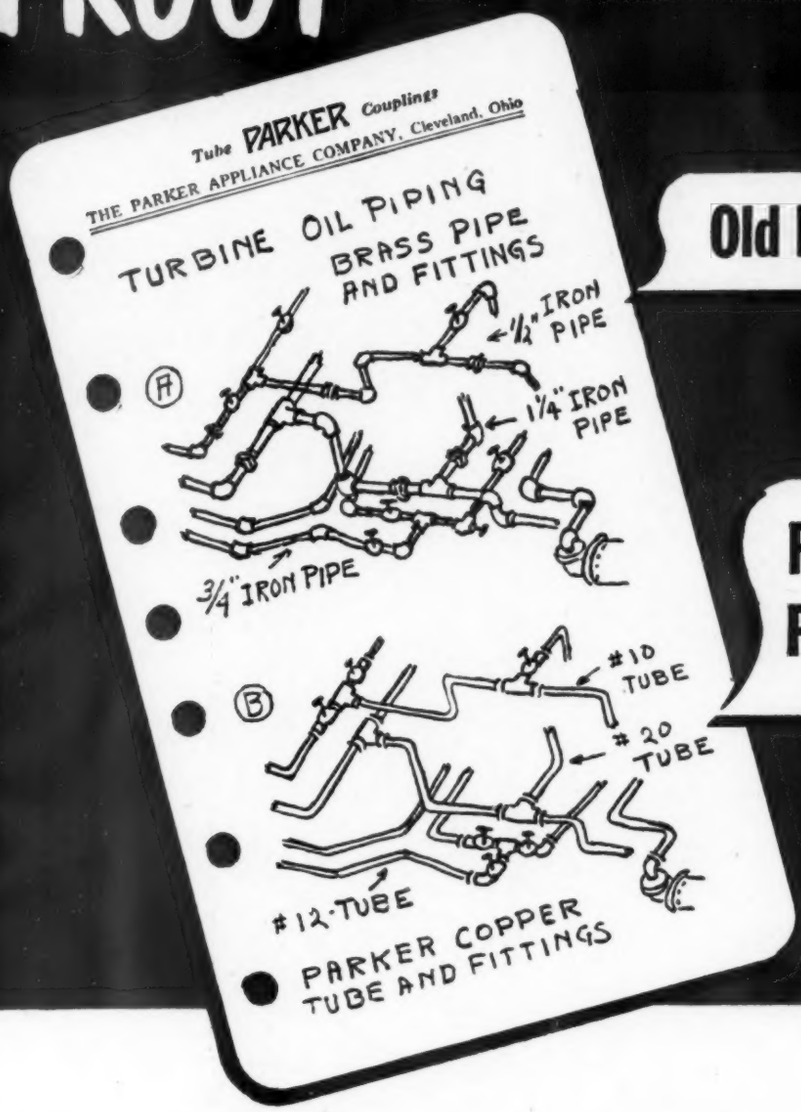
PROOF FROM A PARKER ENGINEER'S NOTEBOOK



You can save time, money and materials with Parker Fluid Power Engineering.

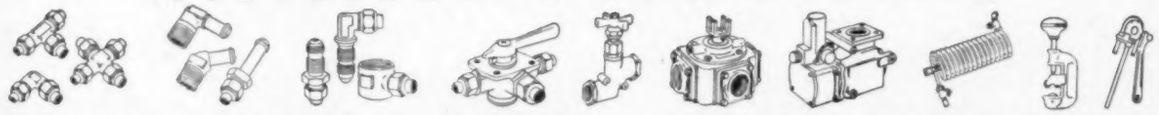
The actual case record pictured is typical. Our recommendation enabled this manufacturer to cut down on number of connections, on space and avoid leakage. Moreover, his customer got a better job—one that operates more efficiently, is easier to service.

We've solved many a manufacturer's problems with equally simple recommendations—using standard Parker equipment. For unusual conditions of design, where stock parts will not serve, we are able to supply "custom-bilt" valves and couplings. In every case the result has been the same—a simplified installation. May we show you how Parker Fluid Power Engineering can do the same for you?

Stocks Available at your Distributor's and at Parker Warehouses

THE PARKER APPLIANCE CO.

CLEVELAND • LOS ANGELES



FLUID POWER PRODUCTS FOR ALL INDUSTRY

To: Hack saw users
A WORD OF ADVICE

Buy STAR Blades

FOR **faster cutting**

FOR **cleaner surface**

AND **they last longer**

HERE'S WHY

1. Keen, sharp teeth; hardened to cut fast and deep, wear longer.
2. Accurate set provides ample clearance and accuracy of material being cut.
STAR
3. Finest grade of high speed steel, scientifically heat-treated gives STAR blades longer wearing and cutting qualities.
4. Large easy to read marking on all STAR blades make it easy to choose the correct type of blade for any job.

FREE — STAR Metal Cutting handbook gives valuable instructions on selection, use, and care of hack saw blades.

TRADE MARK

CLEMSON

CLEMSON BROS., Inc., Middletown, N. Y.
Makers of hand and power hack saw blades, frames, metal cutting band saw blades and the Clemson D-17 lawn machine.

Here's **GROUND FLUTE SUPERIORITY** *in eight reamer types!*

Match the reamer to the job by choosing the correct type from the new L&I line. Then you'll get the utmost in superior performance, for L&I Reamers are the *Ground Flute* reamers.

Grinding *after* the solid bar is heat-treated, guarantees a uniformly hardened tool with a sharper cutting edge that will far outwear ordinary milled-flute reamers.

Improve work quality and lower your production costs with L&I Ground Flute Reamers — available by 64's from 1/16" to 5/16", in wire gage sizes 1 to 60, tapers from 7/0 to #4, and specials to order.

Write for Price List 46 today.

LAVALLEE & IDE, INC. • CHICOPEE, MASS.

L&I GROUND FLUTE REAMERS

NEW COOLANT FILTER SAVES MONEY 7 WAYS

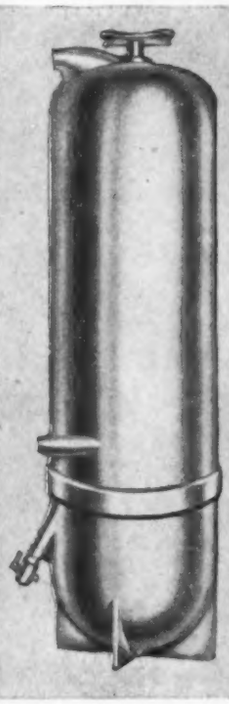
while protecting finishes

You save money first because Cuno's new COOLANT-KLEAN is *priced* lower than most filters. Fewer man-hours of maintenance are needed because the filter element stays clean longer—up to six weeks . . . helping to produce scratch-free finishes. When the element does need replacing, it's a quick job—under 5 minutes. You also save on the cost of elements because each one is priced less . . . and fewer replacements are needed. Grinder coolant stays clean much longer, so that saves money, too. And, seventh, wheel life is greatly extended, so you pay less for wheel replacements.

COOLANT-KLEAN handles full flow of coolant or cutting oil, removing all abrasive and metallic particles which would cause surface imperfections, yet it requires less floor space than other more expensive types. No filter aid needed. No pre-coating. No nuisance of "stuffed type" element. Applicable to individual machine or central system.

Describes "Finer Finishes at Less Cost"

This newest advance in coolant-cleaning is described in Bulletin 3110. Send coupon now for your copy. Find out how simple it now is to obtain finer finishes at less cost.



KEEP FLOW ON "GO" WITH

CUNO

ENGINEERED FILTRATION

CUNO ENGINEERING CORPORATION
242 South Vine Street, Meriden, Connecticut

Gentlemen: Please send information on your new COOLANT-KLEAN filter for grinder coolants.

Name.....

Company.....

Address.....

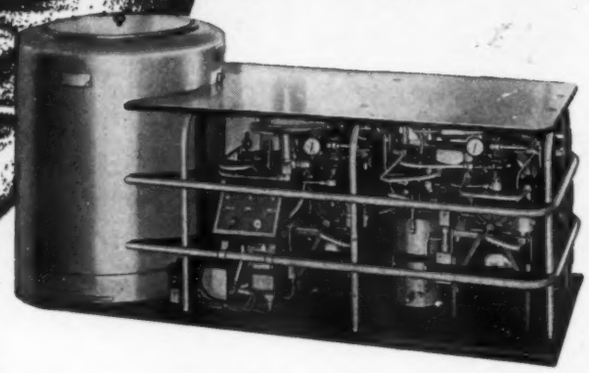
Position.....

Please have representative call ☐

FACTS PROVE

that you need Cold Treating in your plant

Records Su[illegible]
***Deepfree[illegible]* Users Establish**
Cold Treati[illegible] Time-saving [illegible]
to Low[illegible] Quality Production



OPERATION	PART	PERFORMANCE PRIOR TO COLD TREATMENT	PERFORMANCE FOLLOWING COLD TREATMENT
HARDENING	High Speed Drill	48 holes per grind	256 holes per grind
	Tap	40 pieces per grind	500 pieces per grind
	Milling Cutter	7 hours per grind	24 hours per grind
STABILIZATION	Pump Plunger	Operation unsatisfactory due to metal growth.	Perfect operation indefinitely, due to complete stabilization.
	Gauge Blocks	Blocks expanded and warped.	Blocks held original size and shape.
	Lapping Flats	Resurfacing required every 2 to 3 hours.	Resurfacing required every 2 to 3 days.
SHRINK-FIT	Airplane Landing Struts	20 minutes required for assembly.	10 minutes required for assembly.
	Tapered Roller Bearing Race	½ hour to insert in casting.	½ minute to insert in casting.

These performance records are typical of economies obtained in many of the nation's leading industrial plants by the use of Cold Treating in various production processes—economies which can be duplicated under similar conditions in your plant.

Cold Treating is used to accomplish a variety of purposes—all with equal efficiency and economy. Foremost among these are hardening metals and metal parts; stabilizing precision parts, gauge blocks, lapping flats, etc.; shrinking metal parts for rapid assembly; and testing of instruments and equipment for high altitude, low temperature operation. In addition, Cold Treating is performing a multitude of specialized operations too numerous to mention.

You, Too, Can Profit by Using Cold Treating

Whatever your production, a survey of the outstanding results obtained by applying sub-zero temperatures to industrial operations—a few of which are shown in the panel at left—is convincing proof of the economical value and utility of this newest "tool" for industry. Think what such results can mean to your operations in terms of production economies and improved quality of your product.

Let Deepfreeze Engineering Service Assist in Adapting Cold Treating to Your Production

If you are unfamiliar with industrial Cold Treating or are using it on a limited scale and are interested in increasing its range of utility, contact Deepfreeze Engineering Service. Our experienced refrigerating engineers will make a complete study of your product and production setup and enumerate the possibilities and advantages of applying it on the broadest possible scale. This service will not obligate you in any way.

FREE . . . Complete Cold Treating Information

This new 40-page booklet contains all of the facts necessary for a complete understanding of industrial Cold Treating. It explains in detail what occurs within a metal structure when cold treated; illustrates its many uses and resultant savings in time and money; lists up-to-date Cold Treating procedures, gives the names of manufacturers using Deepfreeze equipment; and numerous additional data which you need in applying it to your production. Write today for your copy of Bulletin No. I-4.

Cut REJECTION LOSSES

NORTON ABRASIVES

REWORK with OILSTONE Files

Machined parts, rejected at inspection for scratches, burrs, snug radii or sharp edges, represent a critical investment in scarce materials and high production costs. Expensive machine salvage operations or outright scrap loss can be avoided —for these parts can be quickly reworked, free-hand, with oilstone abrasive files.

Whether on revolving work or bench pieces, the hard, sharp abrasive crystals in Oilstone Files, shaped for conformity to work contours, quickly but delicately remove burrs and sharp edges, refine radii or eliminate binding of mated parts.

India (Aluminum Oxide, oil-filled), and Hard Arkansas (natural abrasive) files offer Industry a complete size and shape range of over a hundred standard stock items with a finish spread from coarse, medium and fine India, to the surgical fineness of Hard Arkansas. Write for descriptive folder, "Oilstone Files."

*

An ABRASIVE File is ALL FILE!

QUALITY ABRASIVES

BEHR-MANNING · TROY, N.Y.

(DIVISION OF NORTON COMPANY)

Also Quality Coated Abrasives Since 1872

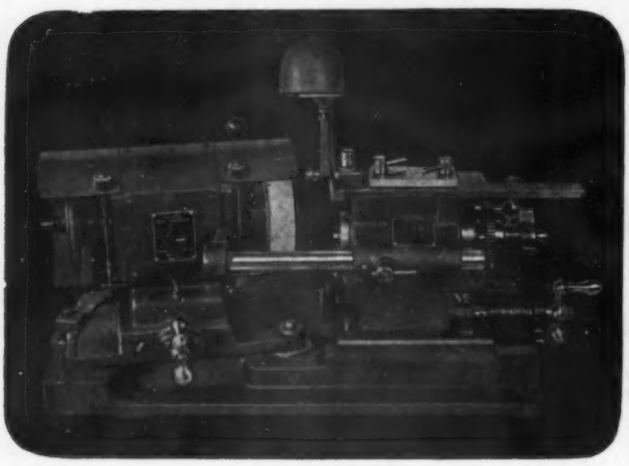
EDWARD **Blake** COMPANY

634 COMMONWEALTH AVE., NEWTON CENTRE 59, MASS.

ACCURATE Tap Sharpening

with only 1 SETUP and 1 CONTINUOUS OPERATION

The BLAKE TAP GRINDER



Accurate sharpening of your dull taps is *quickly and profitably* accomplished on the Blake Tap Grinder. The unique eccentric movement of the workhead allows the tap to be continuously revolved while being ground. This results in *both* the *Chamfer angle and the relief* (of *all* the cutting edges) being ground *at the same time*, in one rapid, continuous operation. Only the initial, quickly-made setup is required.

With the Blake you can sharpen taps with any chamfer angle you may wish . . . with any amount of relief . . . right- and left-hand taps . . . taps with 2, 3, 4, 5, 6, 8 or 10 flutes . . . from size No. 0 to 2" dia.—also countersinks, 3- and 4-flute drills, step drills and many other tools requiring relief on the point.

It will pay you to investigate this speedy, exclusive and profitable method of greatly prolonging the life of your taps. Send the coupon today for complete details, without obligation.

Please send me Bulletin No. 544 which describes the Blake Tap Grinder in detail. A.M.

NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____

BLAKE TAP GRINDERS—FILTAIRE PORTABLE DUST COLLECTORS—AMERICAN TOOL HOLDERS—BLACK DIAMOND PRECISION DRILL GRINDERS—WALTHAM CUTTER SHARPENERS—HAGER CARBIDE TOOL GRINDERS

Tubular MICROMETER

FEATHER TOUCH

INSIDE MICROMETER SETS TU-MI-CO TUBULAR Construction—strong, light, easy to assemble and handle. All tips and connecting surfaces are hardened and lapped for long, trouble-free service. Sets complete with mandrels, wrenches, instructions—in strong wood cases.

TUBULAR MICROMETER CO., ST. JAMES, MINN., U. S. A.

1903 Strand **1946**

FLEXIBLE SHAFT MACHINES

VERTICAL AND HORIZONTAL TYPES

⅛ to 3 H.P.

Type M2—⅛ H.P.

PAY MORE—GET MORE
—DO MORE—

CHEAPEST IN THE END
DEPENDABLE
ALL THE TIME

Type MY7 1½ H.P.

125 Types and Sizes

HIGH SPEED STEEL
ROTARY FILES
ROTARY CUTTERS
ROTARY RASPS

Send for our new 112 page Catalog No. 29. Largest Flexible Shaft Line in the World.

N. A. STRAND CO.

CHICAGO 40, ILL. **5001 NO. WOLCOTT AVE.**

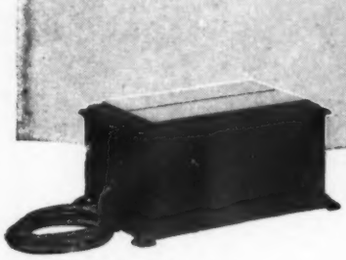
L-W Magnetic Chucks

Guaranteed maximum holding power. Constructed of best materials for long life.

Guaranteed waterproof for wet or dry grinding.

Four sizes, equipped with connections to operate on either 110 or 220 volt D.C.

Size	**5¾" x 13"...**	**$ 47.65**
Size	**6½" x 18"...**	**63.15**
Size	**8" x 24"...**	**109.30**
Size	**10¾" x 37"...**	**202.50**



DEMAGNETIZERS

A single pass over the stationary poles is sufficient to completely demagnetize work that has become magnetized through induction. Model B-2 for large work, complete with pilot light signal, switch and cord. 7¾" wide, 12½" long, 6¾" high. Shipping weight 55 lbs. $63.20
Model J-1 for small work, complete with switch and cord. 7¼" wide, 4¼" long, 6¾" high. Shipping weight 35 lbs. $41.15

RECTIFIERS

For converting A.C. into D. C. for use on magnetic chucks. A.C. input 110 volts. D.C. output 110 volts, 8 amps. Suitable for use with L-W 5¾"x13" and 6½"x 18" magnetic chucks. Two tubes provide ample tube capacity. $38.75. Larger capacity rectifiers also available.

DEMAGNETIZING SWITCHES

for use on our two larger size magnetic chucks. When the switch is thrown to "ON" position, the chuck is magnetized, and the work held firmly for grinding. When the work is to be released, the switch is thrown to "DEMAG" and contacts are touched momentarily to neutralize the chuck. Field discharge type $16.25.
L-W Demagnetizing Switch $8.90.

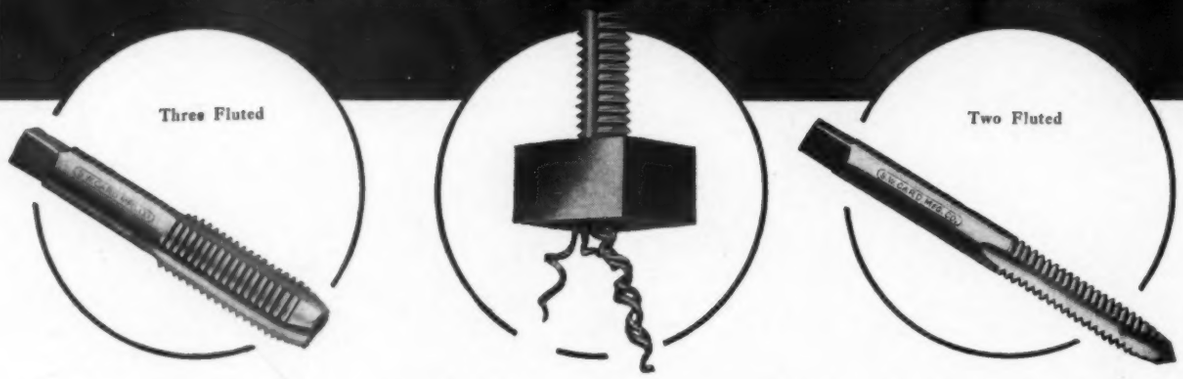
Send for complete catalog giving prices and specifications on these quality, low-cost L-W Products

L-W CHUCK COMPANY

25 SO. ST. CLAIR ST.
TOLEDO 4, OHIO

CARD SPIRAL POINTED TAPS

for free, accurate thread cutting in deep holes



Designed for tapping deep through holes or blind holes drilled deeply enough for chip clearance at bottom of hole. Cutting is done by the first few threads milled at an angle. Chips are forced ahead of tap, preventing chips clogging in flutes, thereby increasing strength of tap and minimizing chances of breakage.

CARD SPIRAL POINTED TAPS assure free cutting, and fine quality threads. Furnished in carbon steel and high speed steel types. Fully described in Card Catalog, available promptly on request.

CARD TAPS ARE SOLD BY LEADING DEALERS EVERYWHERE

S. W. CARD MANUFACTURING CO.

Mansfield, Mass., U. S. A.
DIVISION OF UNION TWIST DRILL CO.
STORES: New York, 61 Reade St., Chicago, 11 S. Clinton St., Detroit, 5527 Woodward Ave., San Francisco, 121 Second St., Seattle, 568 First Avenue, South
Los Angeles, 524 East Fourth Street

Vitrified

BORITE—for all kinds and classes of steel grinding.

CARBORITE—for all classes of cast iron, brass, bronze and aluminum grinding.

Also, Silicate, Shellac and Resinoid Bonded Wheels.

Cuts longer between turns

Vitrified Grinding Wheels assure economy in high quantity production fine precision grinding because they cut longer between each wheel truing. Then, too, these long life, strong wheels require less redressing. They can also be depended on to eliminate gumming, glazing and heating.

All these advantages are available regardless of the grinding job, because there is a size, shape and type Vitrified Grinding Wheel for every grinding purpose. The completeness of the Vitrified line makes it possible for any shop to standardize on Vitrified Wheels.

Our engineers will gladly study your grinding operations and point out the savings you can make through the use of Vitrified Wheels.

VITRIFIED WHEEL COMPANY

WESTFIELD MASS.

VITRIFIED

Why *slow down* a good operator — doing work that can be done *better* by . . .

THE CUSHMAN *power wrench*

fast . . . safe . . .

accurately controlled jaw pressure

DESIGNED AND BUILT BY CHUCK SPECIALISTS TO DO THE JOB *RIGHT*

- Mounting permits fingertip swiveling on bracket. Stop provided on spline shaft to control end movement of shaft as chuck indexes away from workloading station.
- Control box with thumb screw adjusted bar to make possible easy changeover to new torque load and chuck gripping pressure.
- Heavy duty drum switch or push button and reverse line starter control standard equipment as specified.
- Torque motor designed to provide patented brake means thus controlling speed of motor and inertia of rotating parts.

Thoroughly tested and proved on famous production lines, the Cushman Power Wrench furnishes the perfect solution to the problems of opening and closing heavy chucks on repetitive operations. Both the Power Wrench and its electrical control accessories are so simple to operate that the machinist will require but little instruction to become quick and efficient in their use. Yet the equipment has been so carefully engineered that previous difficulties in accurately controlling the torque (and hence jaw pressure) have been completely overcome. With the Cushman Power Wrench torque may be predetermined and set at any desired value from 150 to 600 lbs. ft. at the Wrench end. Action of the Power Wrench is positive and fast with automatic safeguards to prevent starting the head until the Wrench shaft has been withdrawn from the chuck.

For key features see column at left. For Engineering Bulletin giving detailed information, specificaitons and prices, write direct to

THE CUSHMAN CHUCK COMPANY • Hartford 2, Connecticut

A WORLD STANDARD FOR PRECISION

You can depend upon your Cushman Distributor for expert, experienced assistance the solution of your work holding problems. Call on him.

CUSHMAN CHUCKS

HERE'S

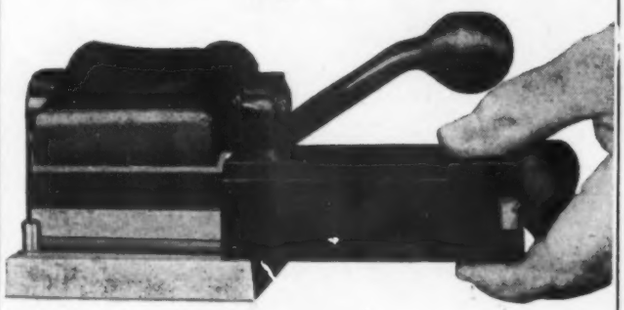
PRODUCTION SPEED

WITH

TOOLROOM PRECISION

FOR

Your Engine Lathe



The Bakewell Toolholder

. . . ideal engine lathe tool for toolroom or production line. As many operations as you want with one set-up

Tool bits for all operations are mounted in interchangeable Bakewell Toolbars.

Single, positive action locking lever permits lightning change of toolbars with no error in tool position from varying pressure on lever. Ample rigidity on heaviest cuts.

Adjusting screw in toolbars allows use of master stop on many production jobs.

Three plane support of toolbars on hardened bearing surfaces assures accurate repeating.

The Bakewell Toolholder has been and is being successfully used on PRODUCTION tolerances of .0005 or closer.

Manufactured in three sizes to fit engine lathes from 9" to 36" swing. Shipped complete with riser plates, Allen wrench and toolbars as ordered.

WRITE TODAY for further details and name of your nearest Bakewell representative.

BAKEWELL PRODUCTS

DEPT. T. A. 2427 E. 14th ST., LOS ANGELES 21, CALIF

Investigate

THE POSSIBILITIES OF THE NATIONAL KEYSEATING MILLER *on Your Work*

Several widths of cutters can be used with each size miller and many different hole diameters keyseated with one tool through the use of eccentric bushings.

• Shops all over the country are solving difficult keyseating problems by chucking this attachment on their drill presses, radials and horizontal boring mills—and milling keyseats in pieces too large or bulky for convenient handling on keyseating machines.

The "National" goes through the hole once and mills keyseats with parallel sides and parallel with the axis of the bore. It's a big time and money saver and is available in standard stock diameters from ½" to 3½" for cutting lengths from 1⅞" to 12". It will keyseat in blind holes, and offset holes. We also manufacture oil-grooving millers.

WRITE today for Catalog No. 16

NATIONAL MACHINE TOOL CO.

CINCINNATI, OHIO

HUOT DRILL INDEX

Made in nine sizes
No. 80 Wire Gauge to 1 Inch

ASK YOUR DEALER . . . OR WRITE TO

HUOT MANUFACTURING CO.
127 E. Ninth St.
St. Paul 1, Minn.

Grobet

ROTARY FILES

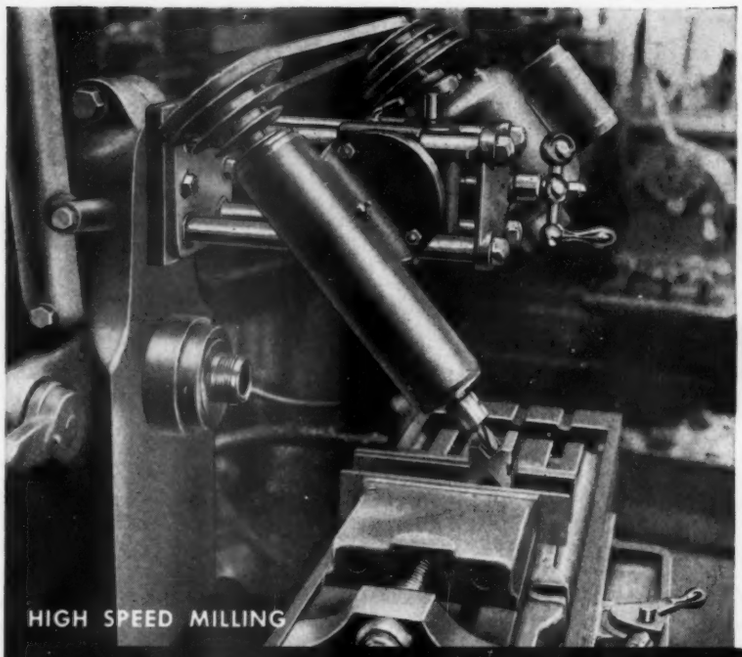
HAND CUT • MILLED CUT
GROUND FROM THE SOLID

There is a Grobet Rotary File, Cutter, Diesinkers Bur in shape, size, and coarseness of cut for every type of hard or soft metal, plastic, wood, etc. Send for Catalog DR. Illustrating the complete line in full size, speed charts, etc.

GROBET FILE CO. of AMERICA

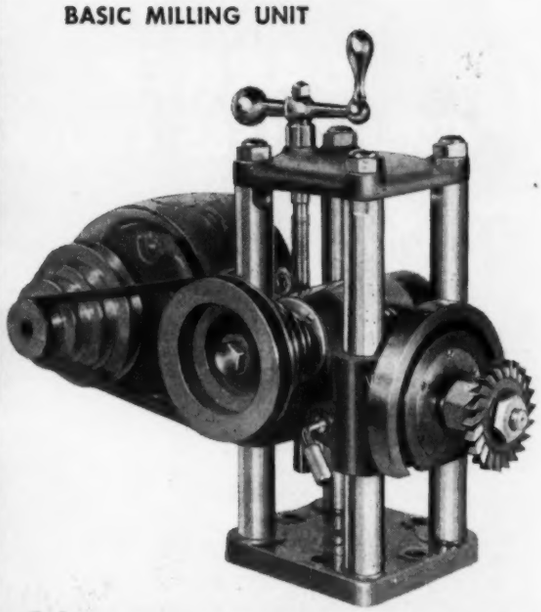
421 Canal Street (1912 P. L. GROBET) **New York, N. Y.**

IMPORTERS OF GROBET SWISS FILES — MFRS. OF GROBET ROTARY FILES



HIGH SPEED MILLING

BASIC MILLING UNIT



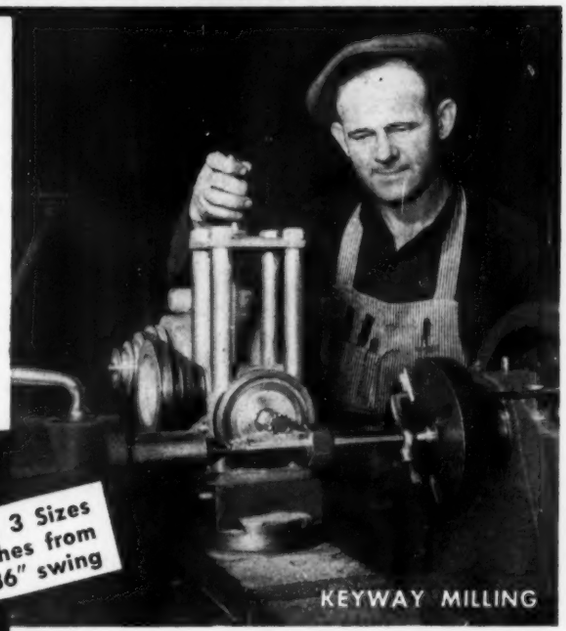
MASTER LATHE CONVERTER

CHANGES YOUR LATHE TO A COMPLETE MACHINE WITH INTERCHANGEABLE HEADS

A Motor Driven Unit for Milling, Grinding, Drilling, Boring, Threading and Keyseating

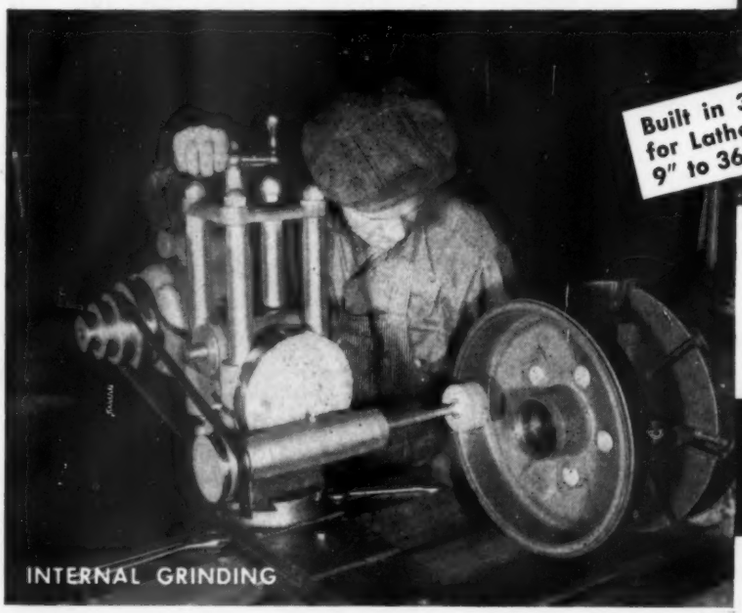
The Master Lathe Converter is designed for use on lathes, planers, shapers, milling machines and boring mills. It can be installed to provide EXTRA operations on work already in place without changing the set-up. It can be readily moved from one machine to another and its work is accurate and time saving.

The Master Lathe Converter is invaluable to maintenance and production men who are frequently called upon to repair broken parts and to make new tools.



KEYWAY MILLING

Built in 3 Sizes for Lathes from 9" to 36" swing



INTERNAL GRINDING

When ordering, specify size and make of your lathe so that the proper mounting clamp can be included with your shipment.

Write for our Operating and Maintenance Manual

MASTER MANUFACTURING CO.

1313 EAST AVENUE A
HUTCHINSON, KANSAS, U.S.A.

BARKER
WRENCHLESS CHUCKS

PRODUCE MORE AT LOWER COST!

Barker Wrenchless Chucks are made in two-jaw and three-jaw types; and as vises for milling machines, drill presses, and similar purposes.

Production goes up—and stays up—when Barker Wrenchless Chucks go on the job. These chucks are simple, rugged, self-contained units, that require no accessories, or outside source of power.

They are easy to install, and from the moment they are put in use they will deliver speedy, trouble-free service that pays liberal dividends—greater number of parts per hour, and lower cost per unit.

Precision built, they will hold to a tolerance of 1/1000" either way on round stock of uniform size. And, they will maintain such accuracy during many years of hard service.

For complete information write for Bulletin No. 201.

THOMAS HOIST CO.
Chuck Division
20 South Hoyne Avenue, Chicago 12, Illinois

Almond Drill Chuck

The Pioneer

Almond Three-Jaw Drill Chucks were Pioneers in their field—the first to be placed on the market. They have formed a necessary part in the logical procedure of machine developments over the past seventy and more years.

Almond Drill Chucks are made in types and sizes *to fit all machine tools and portable drills.*

Write for complete details

T. R. ALMOND MFG. CO.
ASHBURNHAM, MASS., U. S. A.

The Original Manufacturers of Drill Chucks

HARDNESS TESTER

The *Scleroscope* is the only hardness tester that takes in the entire range from the softest to the hardest metals without any adjustments.

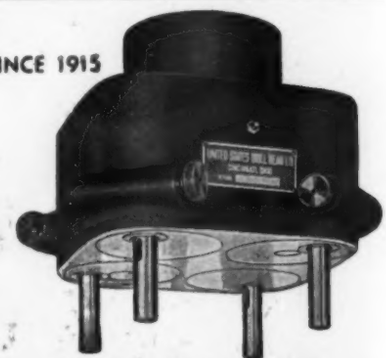
MODEL D-1 DIAL TYPE
Write for Circular!

THE SHORE INSTRUMENT & MANUFACTURING CO., INC.
9025 VAN WYCK AVENUE
JAMAICA, NEW YORK
TELEPHONE: JAMAICA 6-4090

STANDARD US **HEADS** **SINCE 1915**

All Types of Fixed Cents

DRILLING TAPPING & BORING HEADS



Four Spindle Head. All Spindles Adjustable for equally spaced holes.

FIVE TYPES, 56 SIZES, ADJUSTABLE DRILL HEADS
UNITED STATES DRILL HEAD CO., CINCINNATI 4, OHIO

Darnell Casters and Wheels are pre-tested for efficiency and durability—you are assured a long life of satisfactory service.

Free
DARNELL MANUAL

DARNELL CORP. LTD
LONG BEACH 4, CALIFORNIA
60 WALKER ST. NEW YORK 13, N Y
36 N. CLINTON, CHICAGO 6, ILL

OUT OUR WAY

THAT'S TH' BIGGEST STRAIN OF BEIN' TH' HEAD OF ANYTHING! TH' ONES WHO CAN'T GET ALONG WITHOUT YOU ARE TOO QUICK WITH TH' PULMOTOR, AN' TH' ONES THAT CAN'T GET ALONG WITH YOU ARE TOO QUICK WITH TH' STRETCHER!
YEH--BUT IT WAS A TERRIBLE SHOCK! THEY JUST TOLD HIM THAT WE'RE OUTA SOL-SPEEDI-DRI AND THEY FERGOT TO ORDER SOME!
T. M. REG. U. S. PAT. OFF. COPR. 1946 BY NEA SERVICE, INC.
A CRYING SHAME
J.R.WILLIAMS

A crying matter? Sure . . . for when floors become oil- and grease-soaked . . . when their surfaces become ice-slick and dangerous . . . it's *time* to cry for SOL-SPEEDI-DRI, the oil-thirsty absorbent!

SOL-SPEEDI-DRI is a white, granular substance that soaks-up oil- and grease-deposits as a sponge soaks-up water. Just spread it around . . . and immediately, you've got a magic carpet of safety underfoot . . . no slipping or falling with SOL-SPEEDI-DRI on the job. Sweep it up with an ordinary, stiff broom . . . and your floors are bright and safe.

SOL-SPEEDI-DRI puts economy in any industrial plant on a firm foundation. Accident rates go down . . . productive time goes up . . . manpower is saved for other jobs. It works while you work . . . in safety!

SUPPLIERS: East—Safety & Maintenance Co., Inc., New York 1, N. Y.
South, Midwest & West Coast—Waverly Petroleum Products Co., Philadelphia 6, Pa.

SOL·SPEEDI·DRI
OIL AND GREASE ABSORBENT
UL
Get the full story of SOL-SPEEDI-DRI today. Just write "SOL-SPEEDI-DRI" on your letterhead or business card for complete details and a free, generous sample.

WHEN ARE THEY USED

For accurate precision filing, "AMERICAN SWISS" Swiss-Pattern Files are the logical choice of metal-working craftsmen. Tool makers, model makers, watchmakers, instrument makers, all depend on these quick cutting, smooth finishing, uniformly hard files.

"AMERICAN SWISS" Files make filing jobs easier because they stay sharp and produce a perfect cut throughout their length. Make sure that your shop is fully equipped with "AMERICAN SWISS" Swiss-Pattern Files for better filing at lower cost. Over 3,000 different sizes, shapes and cuts available from our distributors. *Write for catalog.*

AMERICAN SWISS FILE & TOOL CO.

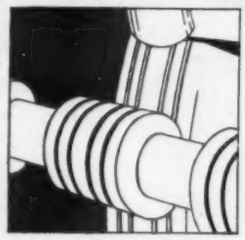
ELIZABETH 1, N. J.

ASK FOR THEM BY NAME

American Swiss ★★★

SWISS PATTERN FILES

CRUSH DRESSED GRINDING



with Oakite Soluble Oil

The crush dressing process of using hardened steel rolls to form or dress grinding wheels is receiving more and more recognition. And grinding operations with crush dressed wheels call for Oakite Soluble Oil in recommended dilutions as the coolant.

Maximum cooling and proper lubrication . . . preventing rust . . . keeping wheels clean and free-cutting . . . are some of the ways in which Oakite Soluble Oil solutions fulfill all fundamental coolant requirements. Let us send you full information about Oakite Soluble Oil. There is no obligation.

OAKITE PRODUCTS, INC., 24 Thames St., NEW YORK 6, N. Y.

Technical Service Representatives Conveniently Located in All Principal Cities of the United States and Canada

OAKITE *Specialized* **CLEANING**

MATERIALS · METHODS · SERVICE · FOR EVERY CLEANING REQUIREMENT

IMPORTED SWISS FIVE RANGE

HAND TACHOMETERS

CENTRIFUGAL TYPE

CATALOG No. 303	CATALOG No. 346
30— 120 RPM	120— 480 RPM
100— 400 RPM	400— 1600 RPM
300—1200 RPM	1200— 4800 RPM
1000—4000 RPM	4000—16,000 RPM
3000—12,000 RPM	12,000—48,000 RPM

FOR DETAILS WRITE FOR BULLETIN NO. 750. NO PRIORITY REQUIRED

HERMAN H. STICHT CO., INC. 27 PARK PLACE NEW YORK 7, N. Y.

RANDALL and STICKNEY

Dial Gauges and Indicators

Model C

are accurate, reliable and built to stand the gaff of hard usage.

This Model C Dial Indicator has a 2½ in. diameter dial, with 50 or 100 divisions. Can be furnished in graduations of .001-in., .0005 in. or .01 mm. Has a ½-in. range movable dial easily set at zero.

The cases on all R. & S. Gauges are made from sturdy castings. The case and plate are two separate units, so that repairs can be made easily.

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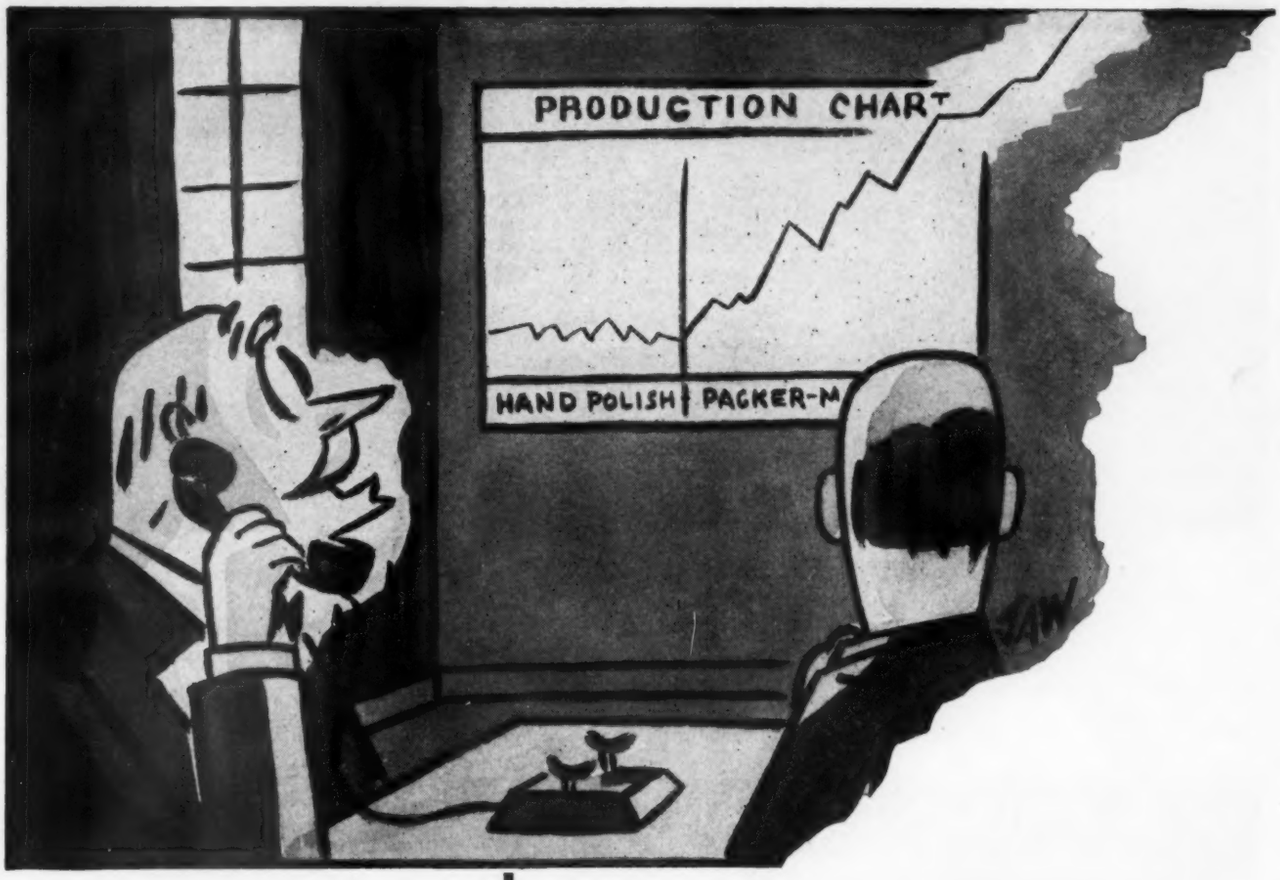

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Your production, too, will soar to new heights when you install Packer-Matic Automatic Polishing and Buffing Machines. But that's not all — you eliminate costly and uncertain free hand operations, insure a uniformly high quality finish and lower both labor and wheel costs! Too good to be true? It seems so until you get the facts.

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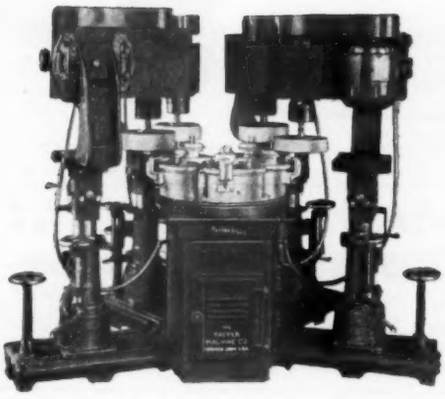

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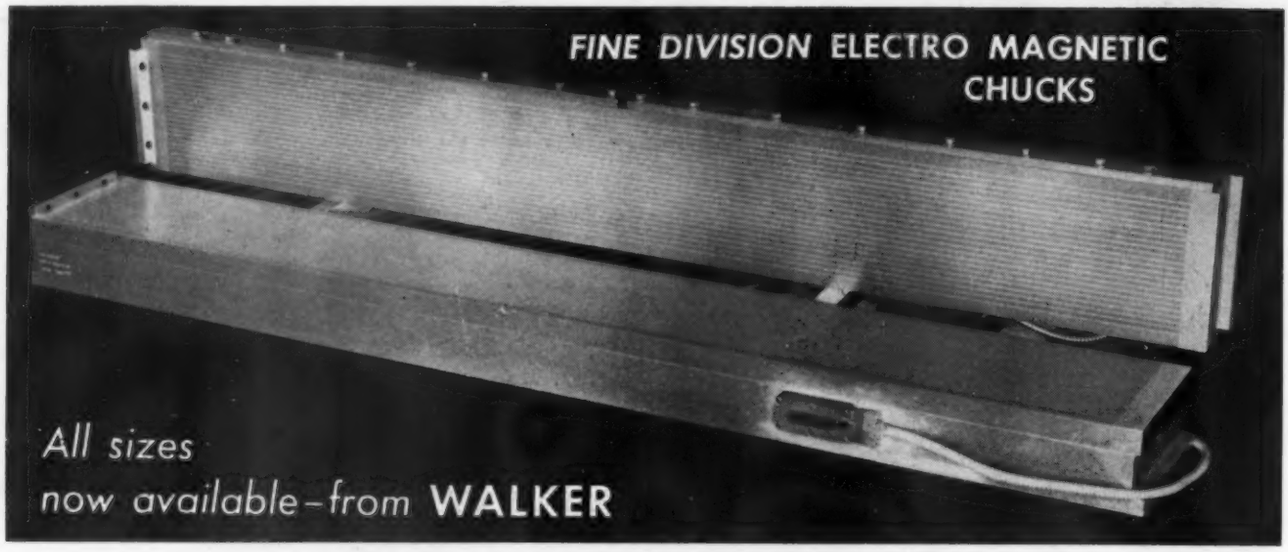

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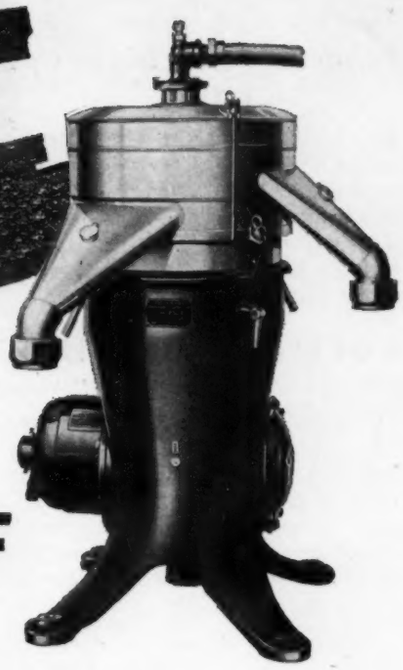

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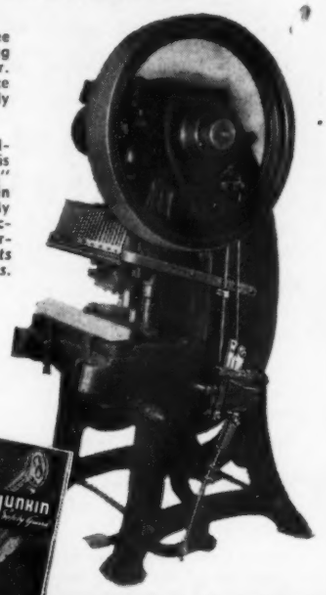

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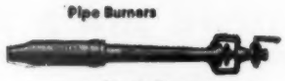

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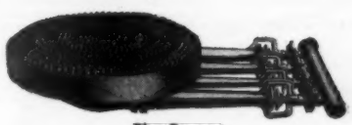

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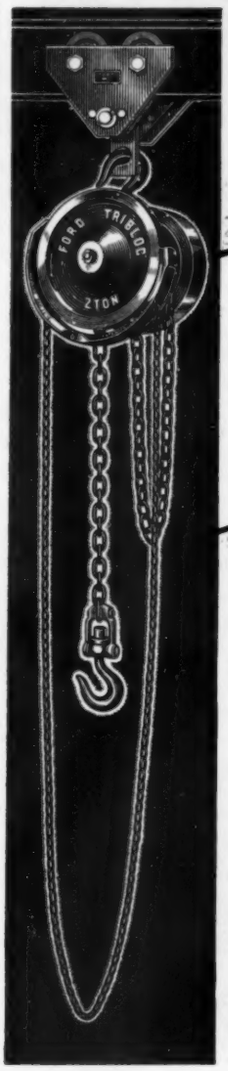

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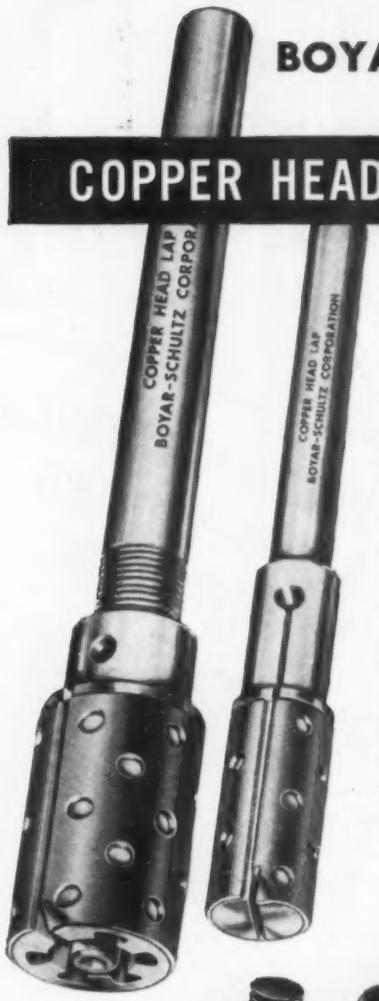

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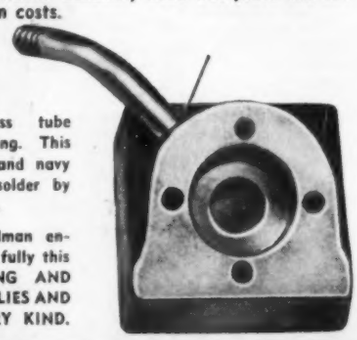

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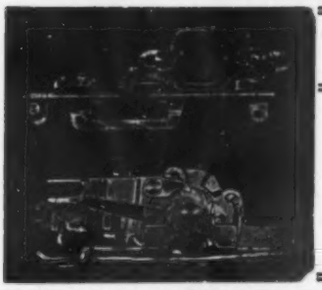

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Additional Contract Work Ads on page 322

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Must be thoroughly experienced in all gear manufacturing problems as well as designing; only those with extensive gear experience need apply. Exceptional opportunity. Write full history including name of university and year graduated; names and addresses of all former employers; age; salary desired.

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P-638, AMERICAN MACHINIST
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POSITIONS VACANT

MACHINE TOOL Manufacturer, located in Midwest, has available capacity at the present time in Planer, Lathe, and Milling Machine Departments. Please address inquires to P-642, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

MECHANICAL ENGINEER: with metallurgical background for cutting oil development work. New York City Socony-Vacuum Oil Co., Inc.

MIDWEST FIRM doing contract stamping and machine work desires shop superintendent. Must have production experience and ability to design and supervise construction of dies and fixtures. Write giving age, experience, and salary expected. Interview arranged at your convenience. Excellent future possibilities. P-643, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

EXPERIENCED FIXTURE designer wanted. Good opportunity for high grade man. Give full particulars as to experience and salary desired. Application will be treated as strictly confidential. Consolidated Machine Tool Company, Rochester 10, N. Y.

EXCELLENT OPPORTUNITY for graduate mechanical engineer having thorough knowledge of design of gearing, speed reducing and speed increasing equipment. Applicant must be of executive type, capablt of assuming complete charge of enginering department. Work would involve design and tooling for production. Good salary. Please reply giving complete experience. Immediate employment to satisfactory applicant. P-644, American Machinist, 330 W. 42nd St., New York 18, N. Y.

SELLING OPPORTUNITIES OFFERED

REAMERS AND milling cutters forged to larger sizes. Life of tool increased 3 to 6 times. Saving 25%. Fully guaranteed. Sales representatives wanted in Cincinnati, Chicago, and Milwaukee. Commission basis. Write Box L, Spring Lake, Michigan.

SALESMAN WANTED by manufacturer to sell as side line, in Michigan, adjustable angle plates, Magnetic parallels and Magnetic V blocks. SW-630, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

MANUFACTURERS REPRESENTATIVES wanted by a large established company, manufacturing industrial reamers. Territories available in a number of sectors. Representatives who are now selling allied but non-competitive lines preferred. RW-645, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

EMPLOYMENT SERVICE

SALARIED POSITIONS $2,500-$25,000. This thoroughly organized confidential service of thirty-six years' recognized standing and reputation carries on preliminary negotiations for supervisory technical and executive positions of the calibre indicated through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 266 Dun Bldg., Buffalo 2, N. Y.

(Continued on page 322)

Management Engineering Executive

Mechanical Industrial Engineer. 30 years of demonstrated ability balancing technical knowledge with common sense. Excellent record of increasing production, reducing costs, developing an efficient organization and handling difficult labor relations. Capacity to direct and accomplish results in a harmonious manner.

PW-636, AMERICAN MACHINIST
330 West 42nd Street New York 18, N. Y.

POSITIONS WANTED

(Continued from page 321)

INDUSTRIAL MECHANICAL Engineer—qualified and experienced in the fields of production control, manufacturing and engineering liaison. Excellent record in developing efficient organizations. Have the capacity to get things done. Six years at present position in the precision manufacturing business. PW-620, American Machinist,330 West 42nd St., New York 18, N.Y.

RESEARCH TOOL and industrial engineer, master mechanic, or superintendent. Technically trained engineer, 11 years in best machine tool companies in America. Yankee, inherent mechanic, and engineer. Wide awake, progressive, speak Spanish. Experienced in modern methods, machines, tools, and systems especially manufacturing thread tools, lathes, and grinders. From materials scheduling to finished products. Minimum salary $6000. Consider assistant position with future, go anywhere, age 32. PW-632, American Machinist, 68 Post Street San Francisco 4, Cal.

MECHANICAL ENGINEER: Desires position as Chief Engineer in small or medium size company. 20 years experience in design, machine shop, production, plant management, cooperative, resourcemul, inventive, good character, successful record. PW-646, American Machinist, 330 W. 42nd St., New York 18, N. Y.

EX-NAVAL OFFICER, 28, arts college graduate with subsequent experience in machine tool operation, production engineering, and plant layout desires position assisting production engineer of medium sized manufacturing concern within 100 miles of N.Y.C. Opportunity to learn and advance is prime consideration. PW-647, American Machinist, 330 W. 42nd St., New York 18, N. Y.

PATTERNAMER: CAPABLE taking over shop estimate cost and layout work to produce accurate sound castings. General pattern shop experience both wood and metal patterns. Know how to handle men and train apprentice. First class mechanic can qualify as working foreman in small shop or supervise large shop. PW-648, American Machinist, 330 W. 42nd St., New York 18, N. Y.

SUPERINTENDENT-FACTORY manager. Industrial executive background of 33 years in the machine and tool manufacturing. Practical and executive experience in the making of precision tools, dies, jigs, fixtures, gages, and special machinery. Trained in the handling of large personnel. PW-649, American Machinist, 330 W. 42nd St., New York 18, N. Y.

MACHINIST: age 33, highly experienced all around, 15 years tool room and precision manufacturing. Motion picture projectors, time recording devices and cannon (ordnance) experience. 3½ years as jr. foreman and setup man in milling machine and automatic duplicating on Pratt & Whitney Kellers and Hydro tels. Seeking employment with a progressive co. PW-650, American Machinist, 330 W. 42nd St., New York 18, N. Y.

CONTRACT WORK

Continued from page 320

SEND B.P. FOR MFG. COMPLETE ASSEMBLIES

Tool—Jigs—Dies
Screw Machine and Turret Lathe Work
Stampings—Gears

POSSY'S TOOL & MFG. CO.
51 Meadowbrook Buffalo 6, N. Y.

HYDRAULIC HOBBING PRESSES

200-Ton Capacity for hobbing mold cavities. Embossing, etc. also fast delivery on presses to your specifications.

M. & N. Machine & Tool Wks.
146 Orono St. Clifton, N. J.

SELLING OPPORTUNITY WANTED

MANUFACTURER'S AGENT, engineering background, now selling outstanding machine component to diversified industrial fields. Will consider additional lines for California. Large following of progressive engineers constantly contacted. Proper representation guaranteed. Give full details. RA-633, American Machinist, 68 Post Street, San Francisco 4, Cal.

MANUFACTURERS: MACHINE tools and industrial equipment: Products must increase operation efficiency and reduce manufacturing costs. Manufacturers representative with finest contacts with machine shops and manufacturers of metal products in northern Illinois excluding Chicago seeking three additional quality product lines. Background—Graduate Apprentice Machinist, Purchasing, Sales, Industry Advisory capacity war-time government agency. RA-651 American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

SALES ENGINEER: establishing in New York desires cutters gauges small tools commission. SA-652, American Machinist, 330 W. 42nd St., New York 18, N. Y.

PATENT ATTORNEY

PATENTS, COPYRIGHTS, Booklet "General Information concerning inventions and patents" and "Fee Schedule" sent without obligation. Established 1915, Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W., Washington 5, D.C.

WANTED

SALES ENGINEERS

To represent a modern gear manufacturing plant. Must have a degree in mechanical engineering as well as extensive selling experience in the gear industry. Write full details including name of university and year graduated; names and addresses of former employers; salary and territory desired and other pertinent details.

SW-609, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

MANUFACTURERS REPRESENTATIVE
PHILADELPHIA & VICINITY

Active in this area for past 25 years possessing sales and executive ability invites correspondence with manufacturers of products salable to Machinery and Machine Tool Users. Organization should be high grade and progressive in product and management.

RA-637 American Machinist
330 West 42nd St. New York, N. Y.

INVENTOR

Offers two patents in partnership deal in precision tool factory.

Or wanted tool engineer perfect in micrometer fabrication for new kind of instrument, with capital for partner.

BO-635, AMERICAN MACHINIST
330 W. 42nd St. New York 18, N. Y.

"Public Domain" gives you

PATENTS for PENNIES!

Over 1000 expiring patents with drawings and typical claims in each weekly 250 page issue —use any of them free for new items! Improve your present product, machinery, etc. Sample copy $1.50; yearly subscription, $45.00; trial subscription, 10 weeks for $10.00.

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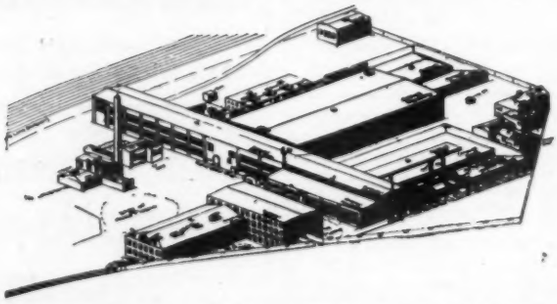
FOR SALE FACTORY AND MACHINERY



Floor Space 130,000 Sq. Ft. Land 351,000 Sq. Ft. 4 Cranes, R.R. Siding, Complete Heat, Power, Air and Lighting Equipment, Sprinklered.

100 HEAVY DUTY MACHINES

Planers, Radial Drills, Millers, Boring Mills, Lathes, Grinders, Drills, Slotters, Gear Cutter, Chucker, Wood-Working and Forge Equipment.

Will Sell Complete or Any Part—Wire for DESCRIPTIVE BOOKLET

FRANKLIN ASSOCIATES
44 CROSS STREET, PROVIDENCE, R. I. **DE. 1701**

Wanted Advertising — page 334

EVERY ITEM GUARANTEED AS REPRESENTED

FALK FOR DEPENDABILITY IN REBUILT MACHINERY

AUTOMATICS

1—#0G Brown & Sharpe Motor Drive
2—#00 Brown & Sharpe High Speed
3—#00 Brown & Sharpe Standard Speed
1—#00G Brown & Sharpe Motor Drive
6—#61 New Britain-Gridley 6 Spindle 1⅝" cap. Automatic Screw Machines. A.C. Motor Drive, Threading Spindle.
1—1¼" Cone 4-spindle Automatic, Motor Driven, Threading Spindle.
1—#515 National Acme 1⅝" 4-spindle Automatics, complete
2—#55 National Acme 1⅝" 4-spindle Automatics, complete
1—#2G Brown & Sharpe Automatic.
1—#1 Brown & Sharpe Automatic, old style.

BORING MILLS

100" Niles-Bement-Pond Bor. & Turn. Mill.
3½" Bar Landis-Rochester Horizontal Boring Mill, Model #36.
#31 Lucas Horizontal Boring Mill, 3" bar.
72" Cincinnati Heavy Pattern Vertical Boring and Turning Mill.

DRILLING MACHINES

Avey, 2 & 3 spindle Prentice, 4 spindle.
Henry & Wright, 6 spindle, #2 M. T.
Fosdick 13" Super speed 4-spindle drills.
Natco #12, 12 spindle #1 M. T.
Natco #14, 22 spindle Rectangular head Drilling Machine.

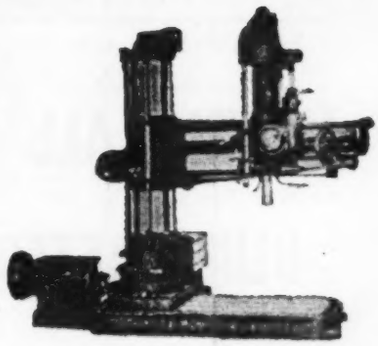
RADIAL DRILLS

3' 9" column Cincinnati-Bickford.
3' 9" col. American, S.P.D.
3' Dreses, 10" col. QCG., M.D.
3' 10" Col. Fosdick.
5' Arm 13" Column Cincinnati-Bickford.

GRINDERS

1—#3 LeBlond Tool and Cutter, Motor Drive
1—#11 Brown & Sharpe Cylindrical Single Pulley Drive

Blanchard Grinder #16, 30" dia. magnetic Chuck, 25 HP 3-60-440 V. Motor.
2—#2 Cincinnati Centerless Grinder.
Pratt & Whitney Vertical Surface Grinder, 14" x 36" with 10" x 36" Magnetic Chuck. Ball Bearing Spindle. Perfect Condition.
#2 Cincinnati Universal Tool and Cutter



Cincinnati-Bickford 5' Arm, 13" round column with air clamp. Oil grooved, tee slotted base, side base, with plain box table with #5 Morse Taper spindle. Motor drive.

#33 Abrasive Vertical Surface.
#3 Abrasive Horizontal Surface.
12" No. 22 Heald Rotary Surface Grinder.
16" Persons-Arter Rotary Surface Grinder.
#4 Brown & Sharpe Universal Grinder.
#12 Greenfield Internal Hydromatic Grinder, sizematic type, complete with Tank and Pump. 15" swing, 5" hole, 4" dee.
Oliver Model 51 Drill Grinder; 1½" cap.
#2 Brown & Sharpe Surface Grinder.
#70 Heald Internal Grinder.
#60 Heald Cylinder Grinder.
#11 Brown & Sharpe Plain Cylindrical.
10" x 18" Norton Cylindrical.

LATHES

14" x 6' Hendey Toolroom, geared head.
14" x 8' LeBlond Toolroom, cone drive.
14" x 12' Hendey Toolmakers, motor drive.
16" x 6' Rockford Toolroom Lathe.
16" x 6' American Motor Driven Lathe.
16" x 8' American Motor Driven, taper.
27" x 18' Lodge & Shipley Geared Head.
26" x 12' Putnam Quick Change Gear.
18" x 6', 20" x 8' American 12-speed geared head, M.D.

TURRET LATHES

4—#4 Warner & Swasey Hand Screw Machines, arr. Motor Drive.
2—#4 Warner & Swasey Universal Hand Screw Machines, arr. Motor Drive.
16" Warner & Swasey Brass Lathe.
#2A Warner & Swasey Universal
#6A Potter & Johnson Automatic Chuckers.
#3R Gisholt Universal like new.
#4 Warner & Swasey Universal
#4 Foster Turret Lathe.

PLANERS

30" x 30" x 10' Cinn. Heavy Pattern, 2 Hds.
20" x 20" x 24" N.-B.-P., Planer Shaper, M.D.

MILLING MACHINES

#3, #4, #5 Cinn. High Power, Plain, S.P.D.
No. 0 Bickett Vertical Bench Miller.
#1-#1½-#2 Brown & Sharpe Plain Miller.
P & W 2½" Duplex Spline Miller.
Hall Planetary Thread Miller 24".
#8 Lees Bradner Thread Miller.
#1, #2 Kempsmith Plain Millers.
#2½, #3 LeBlond Universal.
3B Hendey Universal Miller, single pulley drive.

POWER PRESS HEADQUARTERS

#4 Bliss D. C. Forging Press.
200 ton A.C.F. Hydraulic Press. Bed 24" x 36", 4-post.
3—25 ton K. R. Wilson Hydraulic Presses.
75 ton H.P.M. 2 post, Hydraulic Press.
#1 Bliss Straight Side, double action, Cam Press. Plain flywheel drive, double roll feed.
#22C Ferracute Plain, motor drive.

SHAPERS AND GEAR CUTTERS

20" Gould and Eberhardt Single Pulley Drive
12" Schuchart & Schutte Gear Hobber.
#1 Adams Gear Hobbers, Belt driven (3).
16" Gould and Eberhardt.
21" Smith & Mills B.G. Helical Gears.
24" Gould & Eberhardt Shaper.

SHEARS & METAL WORKING

#2 Hilles & Jones Bending Rolling, 8' x 7/16 drop end.
Lennox Splitting Shear, ¼" cap.; 8' throat.
Lennox Bevel Shear, ¾" cap.
Gould & Eberhardt Slitting Shear, 10 ga.
Bertsch 3"x36" Geared Slip Roll Former.
Niagara 48" Roller Leveller, 6 Rolls.
12" x 12 Gage Loy and Nawrath Geared Underdriven Power Squaring Shear.

MISCELLANEOUS

Waterbury-Farrell Cold Header, double stroke, open die, ½" x 6".
Manville Cold Header, single stroke, solid die, 3/16" cap.
Manville #3 Thread Roller, ⅜ capacity

Thomson Cutter and Creaser, 12½ x 18½.
Heat Treating Furnaces for the tool room.
Hydraulic Pumps—Hele Shaw, Racine, Oil Gear, Motor Driven.
Blake and Knowles 12 x 2 x 12 Simplex Type, Hydraulic Steam Pump, 2000 lbs. pressure with 80 to 125 lbs. steam, delivers 9 gallons per minute.
No. 7B High Speed Riveting Hammer, cap. ¾" to 1½. New this year.
#5A High Speed Riveting Hammer.

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Machinery Merchants

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MOREY DEPENDABLE

SPECIALS:

SPECIALS

INGERSOLL 42x36x16' Planer Type Miller

NILES-BEMENT-POND, Boring Mill—7" Bar—horiz.

MATTISON 16x24x96" High powered surface grinder

GOULD & EBERHARDT #96H Gear Hobber with Differential

NEARLY ALL BUILT AFTER 1941

GRINDERS

HEALD #70 Internal
HEALD #81 Plain Internal Grinder, latest type
BRYANT #5 Internal Grinder, Chucking, latest type
BROWN & SHARPE #5 Pl. Cyl. 3x18; latest
CINCINNATI #2 Plain Cutter Grinder, latest
NORTON 10"x96" Pl. Cyl. Grinder, latest
LANDIS 4x12 Type H Pl. Cyl. Hydraulic; latest type
LANDIS 10x48 Type C Pl. Cyl. Hydraulic; latest type
NORTON 24x240" Pl. Cyl.; motor drive
NORTON 6x18 Surface; latest type
GALLMEYER & LIVINGSTON #25 6"x18" Surface; Hydraulic, latest type
GALLMEYER & LIVINGSTON #35 8"x24" Surface; Hydraulic, latest type
MATTISON 16x24x96 Surface; latest type
MATTISON 14x16x46" surface; latest type
BLANCHARD #16 motor drive; 26" chuck
PRATT & WHITNEY 14x60 Sur. Hydraulic; latest type
ARTER 8" Rotary Surface
ARTER Automatic Piston Ring
BROWN & SHARPE, #1, #2, #3 Univ.; latest
LEBLOND #2 Univ. Tool & Cutter; latest
BROWN & SHARPE #13 Univ. & Tool; latest
BROWN & SHARPE #4 Univ; latest type
NORTON 23x72" Pl. Cyl. Type C latest type
PRATT & WHITNEY Contour Cutter Grinder; latest type
UNIVERSAL Spline Shaft; Hydraulic
OLIVER #510 Twist Drill Grinder—latest type

BORING MILLS—Horizontal

DEFIANCE #26—Timken—latest type
GIDDINGS & LEWIS #25T 2½" Bore—latest type
MORTON boring, drilling, milling and draw cutting traveling head planer 60" stroke
LUCAS #32, 3¾"" Bar; Latest Type
LUCAS #42, 4" bar; latest type
GIDDINGS & LEWIS #0, 3⅛" bar
NILES BEMENT POND, 5' Bar
NILES BEMENT POND, 7" Bar
NILES BEMENT POND—4½" Duplex

BORING MILLS—Vertical

BULLARD 24", 36", 42" New Era Type
BULLARD 54" Spiral Drive; latest type
BULLARD 86" 2 swivel heads, motor drive
KING 72", 2 swivel heads; motor drive
NILES BEMENT POND 84", 2 Swivel heads; Motor Drive
NILES BEMENT POND 120", 2 Swivel heads; Motor Drive
NILES BEMENT POND 90" 2 swivel heads, motor drive
BETTS 120" 2 swivel heads, motor drive

DRILLS

AVEY #1, 3 spindles
AVEY #2, 1 to 6 spindles
LELAND & GIFFORD #1, 1 & 2 spindles
COLBURN #D3; capacity 3"
NATCO #12 multiple spindle
NATCO C-13H multiple spindle
PRATT & WHITNEY #1/2B x 30"; #1/2B x 50", 2 spindle Deep Hole
CINCINNATI BICKFORD 3'9" Radial; latest type
AMERICAN 5'11" Radial; latest type
WESTERN 4', 5'6' Radial, latest type
FOSDICK 5'15" Column Radial, latest type

GEAR CUTTING EQUIPMENT

FELLOWS #7A Gear Shaper
GLEASON 3", 6", 11", 18" Bevel Gear Generators
GLEASON 12" Bevel Gear Generator; late type
GLEASON 10", 15" Spiral Bevel Finisher
GLEASON Bevel Gear Tester
BROWN & SHARPE #13 Gear Cutter
BROWN & SHARPE #6 x 40 Gear Cutter
BARBER COLMAN #3 Gear Hobber
GOULD & EBERHARDT #96H Gear Hobber with Differential
LEBLOND #2 Univ. & Tool; latest ty
CINCINNATI Gear Burnisher
GLEASON 24" Bevel Gear Planer

PLANERS

CINCINNATI 24" Crank
LYND FARQUHAR 26" Open side
CINCINNATI 30x30x10' Box Table, PRT, 2 hds.
CINCINNATI 36x30x5' Box Table, Prt, 1 hd.
CINCINNATI 36x36x12' Box Table, PRT, 4 hds.
HAMILTON 42x42x20', 4 heads
GRAY 48x48x16', 4 heads
CLEVELAND 48x48x16' Open Side, 3 hds.
DIETRICH & HARVEY 48x48x16', 4 hds. Hydraulic
NILES BEMENT POND 96x80x20', Box Table, 4 hds, Hydraulic, PRT
CINCINNATI 120x96x20', 4 hds, box table, PRT

MILLING MACHINES

BROWN & SHARPE #2A Univ., Timken Bearing, latest type
VAN NORMAN #26, #36 Univ., Timken Bearing, latest type
BROWN & SHARPE #2B Pl., standard type, Timken Bearing
KEARNEY & TRECKER #2H, #2K Plain, Timken Bearing
CINCINNATI #3DT Ver., Timken Bearing
GORTON #8, #8½D Vert. high speed latest
KEARNEY & TRECKER #2H (MILWAUKEE) Vert. timken bearing, latest type
KEARNEY & TRECKER #4H (MILWAUKEE) Vert. timken bearing, latest type
KEARNEY & TRECKER #3K, #4K Ver., Timken Bearing

YOUR INQUIRIES ARE INVITED . . .

MOREY MACHINERY

USED MACHINE TOOLS

BROWN & SHARPE #10, #12 Auto., Timken
KEARNEY & TRECKER #1218 Auto., Timken
CINCINNATI 45x48 Hydromatic, Timken
INGERSOLL 36x48x18" Planer Type, 4 heads
INGERSOLL 42x36x16' Planer type, 4 heads
MOREY #12M 2-spindle Milling & Profiler
CINCINNATI #0-8 Vert. Timken Bearing, latest type
CINCINNATI #2 Timken, dial type, Ver.
CINCINNATI #3 Vert. Timken Bearing, latest
KENT OWENS #2 RV Hand Miller, Timken Bearing, latest type
CINCINNATI #0-8 Plain Auto. miller, Timken bearing, latest type
CINCINNATI #1-12 plain auto miller, Timken bearing, latest type
CINCINNATI #1-18 plain auto miller, Timken bearing, latest type
CINCINNATI #4-36 Hydramatic Timken bearing—latest type
CINCINNATI #56-108 Hydramatic Timken bearing—latest type
CINCINNATI #2 plain miller, Timken bearing—dial type
CINCINNATI #4 plain miller, Timken bearing—dial type
CINCINNATI #5 plain miller, Timken bearing—dial type
KEMPSMITH #2 Timken Bearing, Latest Type

JIG BORERS

CINCINNATI BICKFORD 28", latest type
LINLEY High speed, latest type

THREAD MILLING MACHINES

PRATT & WHITNEY 4½x12, 6x20 Model C, latest type
LEES BRADNER Model LT 6x36, latest type
PRATT & WHITNEY 6x120, 6x132, M.D.
MOREY SHIELDS 12x30, 12x60, 12x120, 12x192, latest type

SHAPERS

JONES 6" Vertical, latest type
PRATT & WHITNEY 6" Vertical
MOREY 10" Vertical, latest type
PRATT & WHITNEY 10" Vertical
MOREY 14" Vertical, latest type
MORTON 30" Draw Cut
DILL 18" Vertical Slotter

LATHES

MONARCH 10x20 centers Model EE, Timken bearing, latest type
MONARCH 14x30 centers Timken Bearing, latest type
MONARCH 14x54 centers Timken bearing, latest type
HENDEY 14x6' bed, geared head, M.D.
HENDEY 14"x42" Centers; Timken Bearing, latest type
HENDEY 16"x30" Centers; Timken Bearing, latest type
HENDEY 16x6' bed, geared head, motor drive
AMERICAN 16x8' bed
LODGE & SHIPLEY 18x8' bed, geared head
LEBLOND 16"x5' Centers; Timken Bearing, latest type rapid production
LEBLOND 16"x102" Centers; Timken Bearing, latest type
LEBLOND 18x54 centers, Timken bearing, latest type
LEBLOND 21x16' bed, geared head
MONARCH 16"x78" Centers; Timken Bearing, latest type
MONARCH 30"x10' bed, Timken Bearing
HENDEY 12x54 centers Mfg. Type
HENDEY 14x42 centers Mfg. Type; latest
HENDEY #3x54 centers Mfg. Type
LEBLOND 20"x10" Centers—timken bearing, latest type rapid production
LEBLOND 17x6', 9' and 14' bed Timken, Mfg. Type
AXELSON 20"x126" Centers; latest type
LEBLOND 20"x144" Centers; latest type
SENECA FALLS 8"x60" Lo Swing Timken Bearing, latest type
SENECA FALLS 3"x108" Lo Swing Timken Bearing
LEBLOND 20"x140"; latest type

LATHES—TURRET

MOREY #2G, 1" cap. Timken Bearing
MOREY #3 Univ., 1½" cap. Timken Bearing
MOREY #4 Univ., 2" cap. Timken Bearing
WARNER & SWASEY #1A Univ. Timken Bearing
WARNER & SWASEY #2A Univ. Timken Bearing
WARNER & SWASEY #3 Univ. 1½" cap. Timken Bearing
BORDONS & OLIVER #3, latest type
GISHOLT #2L Univ. Timken Bearing
POTTER & JOHNSON #6C; motor drive
JONES & LAMSON #3 Univ. Timken Bearing—latest type
JONES & LAMSON #5 Univ. Timken Bearing—latest type
JONES & LAMSON #7C Univ. Timken Bearing—latest type
WARNER & SWASEY #3A Univ. Timken Bearing—latest type
GISHOLT #3 Univ. Timken Bearing—latest
GISHOLT #4 Univ. Timken Bearing—latest
LIBBY 1Y-5 Timken Bearing—latest type

AUTOMATIC SCREW MACHINES

CLEVELAND ⅞" to 2½" Model A
BROWN & SHARPE #4 Automatic, latest
CONO-MATIC 3½", 4 spindle, latest type
NEW BRITAIN #65—latest type

PRESSES

CLEARING #SO-842 single action, 215 tons, latest type
CLEARING Type K-1200-30 Knuckle Joint, 200 tons, latest type
CLEARING Type F-1100-36 single action, 100 tons, latest type
CLEARING Type 730 single action, 160 tons, latest type

MISCELLANEOUS

CLEVELAND 12x16" Cutter Relieving Machine
COLONIAL Model FS-2-72 Broach
WATSON STILLMAN Hyd. Straightening Press
BLOUNT 4"x6' Speed Lathe
SAUNDERS #9, 8 to 18" Pipe Machine

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QUALITY *Machine Tools*

NOW IN STOCK

★ 36" x 168" Mattison Surface Grinder, with magnetic chuck, wheel dresser and motors. (New in 1943).

★ No. 60 New Britain Six Spindle Automatic Screw Machine, 1" bar capacity. (New in 1943).

AUTOMATICS
No. 61 New Britain, 1⅝" capacity.
16" x 33" Fay Automatic Lathe.
1" x 5" New Britain Automatic, six spindle.
⅞" Cleveland Model M, four spindle.
No. 00, 0, 2G Brown & Sharpe.

DRILLS
4 ft. Carlton Radial, enclosed head.
No. D2 Colburn, single spindle.
42" Barnes, sliding head.
Allen Sensitive Drill, four spindle.
No. 11 Natco Multiple Drill, 16 spindle.
★ No. 3 Baush Multiple Drill, 20 spindle, No. 2 Morse Taper, rectangular head 20" x 40".

GEAR CUTTERS
No. 61 Fellows Gear Shaper, m.d.
No. 5AC Lees Bradner Gear Hobber.
6" Gleason Straight Bevel Gear Generator.
No. 5—48" Cincinnati Automatic Gear Cutter.

GRINDERS
No. 3 Abrasive Surface Grinder.
No. 22 Heald Rotary Surface Grinder.
No. 10—26" and No. 16—30" Blanchard Surface Grinder.
76" Rogers Knife Grinder, Type B.
No. 72A3 Heald Gagematic Internal Grinder.
No. 70 and 75 Heald Internal Grinders.
No. 13 Brown & Sharpe Universal & Tool Grinder.
14" x 48" Landis Universal, hyd.
10" x 36" Norton Cylindrical Grinder.
10" x 50" Norton Cylindrical Grinder.
No. 2 Cincinnati Centerless Grinder.
★ No. 3 Cincinnati Centerless Grinder, m.d.

LATHES, ENGINE
★ 12" x 30" Hendey, Geared Head, new in 1944.
20" x 8' Sidney "Monotrol", g.h.
24" x 30' Lodge & Shipley, g.h.
18" x 8' Monarch, g.h. Timken spindle.
16" x 6' Hendey, g.h.
★ 15" x 30" Lipe Carbo-Matic, new in 1943.

LATHES, TURRET
★ No. 4L Gisholt, 9¼" spindle, chucking.
No. 3B Foster, Timken spindle.
No. 1A, 2A Warner & Swasey.
No. 5 Warner & Swasey Universal, G.H. Timken spindle.
No. 6D Potter & Johnston Automatic Chucking and Turning Machine.

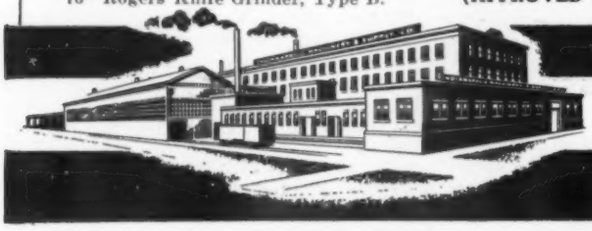
MILLS
No. 4A Brown & Sharpe Universal, s.p.d.
No. 3B Milwaukee, plain, m.d.
No. 4 LeBlond Plain, c.d.
No. 2A Brown & Sharpe Universal, c.d.
No. 1 Brown & Sharpe Universal, c.d.
No. 0-8 Cincinnati Plain Automatic, m.d.
★ 18" Cincinnati Plain Mfg., m.d., new in 1943.
No. 3-36 Cincinnati Hydromatic Duplex, m.d.
4" Pratt & Whitney Spline Mill.
42" Bullard Vertical Boring Mill.

MISCELLANEOUS
No. 100 Micromatic Hydrohoner.
No. 3 Long & Allstatter Multiple Punch, m.d.
Schraner Crankshaft Lapping Machine, Model B.
8" x 7" Troy Vertical Steam Engine.
No. 72 Etna Rotary Swaging Machine.

PLANERS AND SHAPERS
24" American Shaper, c.d.
28" Gould & Eberhardt, m.d.
★ 6" Pratt & Whitney Vertical Shaper.

SAWS
9" x 9" Peerless, Hydraulic.

(APPROVED DEALER FOR WAR ASSETS CORP. SURPLUS MACHINES)



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No. 12 B & S Mills
Heald No. 72A3 Grinders

D. E. DONY MACHINERY CO.
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Boring Mills, 36"-42"-52"-72"-96.
Belt Cutters, 1"-1½"-2"-2½" Acme-Landis
Press, Forging 1000 Ton United St.-Hyd.
Planer, 36"x36"x12' Powell 4 Hds.
Planer, O. S. 60"x60"x14' D. & H., M.D.
Planer, 12'x12'x34', 4 Heads, M.D.
Profiler, #13 P. & W., B.D.
Shapers, 10"-20"-24"-36".
Shaper, 36" Morton Draw Cut

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SIZES AVAILABLE

10 x 36	14 x 36	18 x 96
10 x 50	14 x 50	18 x 120
10 x 72	14 x 72	24 x 96
10 x 96	16 x 50	24 x 240
	16 x 72	

HILL-CLARKE MACHINERY CO.
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Van Norman #3V Vertical Milling-Machine—Ram Type—1942 Mfg.

DRILLS
Cincinnati-Bickford 4' 13" column Radial—1942
Morris 3' 9" column Radial—1941
Western 5' Radial—motor drive
Natco #D5 Multiple-motor drive—latest type

GRINDERS
Norton Cam, mtr. dr.—late type
Cinn. Centerless Grinder #2—arr. M.D.
H & G Chaser—excellent condition
Porter Cable BG-8 Belt Sander—1942
Reid #2B Auto. new

LATHES
Lodge and Shipley 14"x30" Geared Head, T.A., 1942
American 14"x6', G.H., SPD, TA
Prentice Bros. 24"x18' Grd. Hd., mtr. dr.
Blaisdell 24"x10', LCG, TA
American 14"x8' 12 speed G.H., T. A., motor-in-base, collets, late type
Prentice 12"x6', G.H., mtr. dr.
Pratt and Whitney 14"x6', SQCG, TA
Hardinge Prec., on bench with equip.
Lodge & Shipley 20"x6'—G.H.—T.A.

TURRET LATHES
Jones and Lamson 2¼x24" Steel hd., 1936 Mfg.
Foster #2 geared head 1" Cap.
Gisholt 21" Univ., T.A.

MILLING MACHINES
Kempsmith #2G, Plain, 1942
B&S #2B Plain, all geared
P&J #2M Dual Table, latest type, mtr. dr.

MISCELLANEOUS
36"x36x310' Powell Planer, 1 side head, 1 rail head
30"x30"x10' Putnam Planer, 2 head, box bed
36" Gisholt Vert. Boring Mill, 2 hd., Arr: M.D.
#DT 42½B Pels Automatic Beam Shear
#1A Gorton (Pantagraph) Engraving machine
48" Apron Folder (power) 14-gauge
72" 14-gauge Dreis & Krump Apron Brake
3000# Chambersburg Board Drop Hammer

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EVERY MACHINE MOTOR DRIVEN—EXCELLENT CONDITION

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BORING MILLS

#340T Giddings & Lewis Horizontal Table type

DRILLS

24" Henry & Wright Single Spindle Sensitive
#2-26" Leland Gifford Single Spindle Sensitive
#2-14" Leland Gifford Two Spindle Sensitive
Three—#4-24" Fosdick Two Spindle Sensitive
Two—#1-12" Leland Gifford Four Spindle Sensitive
Two—#2-14" Leland Gifford Four Spindle Sensitive
#2-26" Leland Gifford Four Spindle Sensitive
Two—#4-16" Fosdick Four Spindle Sensitive
Two—#4-24" Fosdick Four Spindle Sensitive
Three—#D-5 Natco High Speed Multiple Spindle
3' Cincinnati-Bickford Motor-on-arm Radial
Model GL Kingsbury Five Spindle Horizontal

GEAR MACHINERY

#3 Barber-Colman Gear Hobber
2—3" Gleason Straight Bevel Gear Generator
Two—3" Gleason Spiral Bevel Gear Generator
#6 Gleason Straight Bevel Gear Generator
#7 Gleason Spiral Bevel Gear Generator
#615A Fellows Gear Shaper
#13 Brown & Sharpe Automatic Gear Cutter

GRINDERS

#1 LeBlond Universal Cutter
12" x 28" Landis Universal & Tool
#14S Hammond Double End Carbide Tool
Two—#2 Brown & Sharpe Surface
#35 Gallmeyer & Livingston Hydraulic Surface
#45 Gallmeyer & Livingston Hydraulic Surface
6" x 18" Cincinnati Model ER Hydraulic Plain
Two—#11 Brown & Sharpe Plain
#30A Brown & Sharpe Plain
16" x 96" Landis Plain
Two—#1 Brown & Sharpe Universal
10" x 24" Landis Hydraulic Universal
#3 Brown & Sharpe Universal
Two—#3 Bryant Heavy Duty Hole
#72A3 Heald Internal
#72A5 Heald Bridge Type Internal
#2 Cincinnati Centerless

LATHES

Twenty-Five—9" Cataract Bench
Nine—10" x 20" Pratt & Whitney Bench
Two—#608 Rivett Bench
10" x 30" Hardinge
#1 x 30" Hendey High Speed
Two—12" x 30" Hendey Motor-in-base Geared Head
14" x 30" Pratt & Whitney Model C Geared Head
14" x 30" Hendey Motor-in-base Geared Head
Three—14" x 8' Hendey Model ECM Geared Head
#12 Gisholt Automatic Production

MILLING MACHINES

#3½ Fox Plain
#2 Brown & Sharpe Plain
#3B Brown & Sharpe High Speed Motor-in-base Plain
#2L Cincinnati Plain
Two—#2 LeBlond Plain
#12 Van Norman Ram Type Universal
Two—#22 Van Norman Ram Type Universal
#0-8 Cincinnati Vertical
#1-18" Sundstrand Hydraulic Rigidmill
Taylor & Fenn Duplex

PLANERS

42" x 42" x 30' Gray Two Head

SCREW MACHINES

Three—#00G Brown & Sharpe High Speed
Three—#2 Brown & Sharpe High Speed
Three—#2G Brown & Sharpe
Two—½" Cleveland Model A Geared Head
1—1/16" Cleveland Model A Geared Head
1¼" Cleveland Model A Geared Head
1⅜" Cleveland Model A Geared Head
Three—1⅜" Cleveland Model AA Geared Head
Two—2½" Cleveland Model A
Two—3¾" Cleveland Model A
4½" Cleveland Model A
Five—5½" Cleveland Model A
Five—9/16" National Acme Model C Five Spindle

TURRET LATHES

Two—#1 Brown & Sharpe Wire Feed
Five—#1 Warner & Swasey Electric Head
Three—#2 Warner & Swasey Geared Head
Three—#3 Warner Swasey Universal Geared Head
Three—#4 Warner & Swasey Geared Head
Two—#6 Warner & Swasey Geared Friction Head
Two—#1A Warner & Swasey Universal Geared Head
#5 Warner & Swasey Universal Geared Head
Five—#5 Foster Universal Geared Head
Two—#2F Foster Fastermatic Universal Geared Head

MISCELLANEOUS

Two—25 Ton Hydraulic Presses
30" Pratt & Whitney Vertical Miller & Profiler
Model BC4 Jones & Lamson Bench Optical Comparator
#213 Campbell Wet Abrasive Cutting Machine
#401 Campbell Cutamatic Wet Abrasive Cutting Machine
#425 Campbell Cutalator Wet Abrasive Cutting Machine

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GEARED HEAD, MOTOR DRIVEN

SEBASTIAN "H" 16"x8' Bed—Timken Bearing
LODGE & SHIPLEY 16"x54' Centers—Timken Bearing
PRATT & WHITNEY "C" 16"x78' Centers—Timken Bearing
AXELSON 24"x72" Centers, 24 speed—Timken Bearing
AMERICAN 27"x96' Centers, —Timken Bearing
LEBLOND 27"x96' Centers— Timken Bearing
AMERICAN 36"x15' Bed; 20' bed, 22' bed
BRIDGEFORD 36'x28', 32', 35' Bed—2 Carriages
NILES—36"x25' Centers—2 Carriages; PRT—Timken Bearing
BRIDGEFORD 42"x35' Bed—2 Carriages
AMERICAN 42"x40' Bed—2 Carriages

LATHES—TURRET

BARDONS & OLIVER #5 Univ.; Timken Bearing; chucking
BARDONS & OLIVER #7 Univ.; Timken Bearing; chucking
ACME #1 Universal—Timken Bearing
FOSTER #2F Univ. Fastermatic; Timken Bearing
FOSTER #3F Univ. Fastermatic; Timken Bearing

UNUSUAL OFFERINGS

LeBLOND 48" x 22' Centers Lathe
LeBLOND 48" x 34' Centers Lathe
LeBLOND 48" x 40' Centers Lathe
NILES 36" x 25' Centers Lathe
POWER RAPID TRAVERSE, 2 CARRIAGES, TIMKEN BEARING

LATHES—BORING

NILES 30"x50'
NILES 30"x46'

GRINDERS

CINCINNATI 6"x30" Plain Hydraulic; Model EA
ABRASIVE #3 Surface
PRATT & WHITNEY 14"x60" Vertical Surface—Hydraulic
BROWN & SHARPE #13 Universal
HAMMOND Type WH Model A Pedestal Grinder
FOX #8 Swing Frame

SAWS

PEERLESS 10"x10" Universal Hack
MARVEL #18 Hydraulic Roll Stroke Hack, 18x18"
PEERLESS 14"x14" Hack
CAMPBELL #401 Cutamatic Wet Abrasive Cutting Machine 6"

PLANERS

LIBERTY 24"x24"x8'; 1 head on cross rail, 1 side head, A.C. Vari. Voltage Drive

MILLING MACHINES

HALL Planetary Millers, Style C & D
BROWN & SHARPE #2-B Plain—Timken Bearing
KENT-OWENS #1M Hand; ball bearing, M.D.

BORING MILLS—VERTICAL

NILES 42", 2 swivel heads, power rapid traverse
NILES 53", 2 swivel heads, power rapid traverse

MISCELLANEOUS

BRINELL Automatic Direct Reading Hardness Testing Machine
SUTTON #2 Single Head Horiz. Straightening Press, to straighten up to 6½" bar.
GREENARD #6 Arbor Press
BLISS #6 Arbor Press
RHENBERG-JACOBSEN Centering Mach.
BUFFALO #16 SS Drill Press

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Make	*Tons*	*Stroke*	*Die Space*
Woods Hydraulic	1800	18"	10'x 8'
3 Minsters	93	2½"	31 x 24
Bliss #306½	150	7"	27 x 27 geared
Bliss #304	50	8"	18 x 18
Bliss #305	93	9"	24 x 24
Toledo #90-C	50	8"	32 x 24 geared
Bliss #68C	35	1" draw	21 x 10
Deep Draw	50	4" draw	12 x 12 geared
Bl. & John. #3	20	1¾"	17 x 13
Bl. & John. #5	30	½"	13 x 13 Pillar
9 V&O #10	20	1½"	14 x 6½
9 Bliss #58	18	5"	15 x 7½
15 Air Hydraulics	2½-5	2"-5"	11" Round New

BRAKE, PRESS, ROBINSON—8½' x 3/8" cap.

BORING MILL—Lucas #41—3"—Late. Gisholt 4", serial 5/962 with 8 arbors. b.g. knee type, rapid traverse, not motors. Price $475.

BROACH: Hydraulic La Pointe #3-L. Late

DRILL PRESS: 60" swing, No. 5 Morse taper, h.d., $150

GRINDERS: (2) Surface, Robots—No. 2 Mag. chuck, 6"x18", motor like new (1944)—$975 ea. Blanchard #18, 30" chuck.

LATHES: LeBlond 16"x6' QC motor. Price $850.

Hendey 16"x6', QC taper motor. Price $750.
Fay & Scott 16"-36" sw. x 4'-9' centers, sliding gap motor. Price $1050.

MILLERS: (2) Morey No. 12M Vertical Miller & Profiler (1941). Power feed, completely motorized, 2 spindle, original cost $3700 ea. Our Price $750 each.

Farnham Countersinking Mill, 36" Reach, Hydraulic, motorized, 1942. Cost New $1775. Our Price $375.

TURRETS: (25) New-Denver 6" Chuckers—geared head Universal (Fraction of cost)

THREAD ROLLER, NATIONAL 3/8" to 1" diam.

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2—1⅝" Cone Automatic Screw Machines, motor driven, 8-spindle type.

1—3¾" Cleveland Automatic Screw Machine. New 1942 used about 400 hours.

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60" KING, two swivel heads, all geared power feeds, M.D.
72" COLBURN, two swivel heads, all geared power feeds, M.D.
73" NILES-BEMENT-POND, two swivel heads, all geared power feeds, M.D.
84" CINCINNATI Rapid Production Type, one swivel head, one turret head
96" CINCINNATI Rapid Production Type, two swivel heads, M.D.
100" NILES-BEMENT-POND, two swivel heads, all geared feeds, M.D.
120" BETTS Heavy, two swivel heads, all geared feeds, power rapid traverse.
10/16' CINCINNATI Massive Pattern, two swivel heads and extension boring head.

MILLERS

42" x 26" x 12' INGERSOLL Planer Miller, 4 heads, M.D.
No. 4 CINCINNATI High Power Plain, Power rapid traverse table 16½" x 64". Single pulley belt drive or AC or DC.
Nos. 2, 3 and 4 CINCINNATI High Power Vertical adjustable head, P.R.T.
No. 5 CINCINNATI Plain Rectangular overarm, table overall 21" x 83".

LATHES

30" x 18' LODGE & SHIPLEY Selective geared head, taper attachment.

36" x 30' LODGE AND SHIPLEY 18 speed selective geared head screw cutting engine lathe, 2 carriages. AC or DC motor drive.

42" x 36" PUTNAM Geared Head, 25' between centers. Quick change gear box.
#3 NILES-BEMENT-POND, axle lathe, M.D.
42" PUTNAK Car Wheel, M.D.
79" NILES-BEMENT-POND Driving Wheel, M.D.
60" x 48' N-B-P Geared Head Engine Lathe.

RADIAL DRILLS

4' AMERICAN Plain triple purpose enclosed head drill, tapping attachment.
5½' AMERICAN Full Universal Triple Geared Tapping Attachment.
6' AMERICAN Triple purpose, plain radial, motor on arm.

GEAR HOBBER

100" GOULD AND EBERHARDT Horizontal for spur, helical and worm gears. Max. capacity 101" diameter. 48" face. Forced feed lubrication.

PLANERS

48" x 48" x 15' NILES-BEMENT-POND four heads, 230 volt, D.C. reversing type planer motor and control.
72" x 72" x 15' N-B-P Heavy 4 heads, double deck table. 230V, DC Reversing motor drive.

16' x 10' x 30' BETTS Heavy, 2 heads on rail and 2 side heads, forced feed lubrication. 230 V DC reversing type planer, motor and control.

SLOTTERS

6" & 10" PRATT & WHITNEY Vertical Shaper with rotary table, power feeds, tilting ram. AC or DC motor drive.
14" STEPTOE Crank Shaper.
15" NEWTON Crank Slotter, 30" circular table, AC or DC.
16" SPRINGFIELD Crank Shaper.
18" DILL Crank Slotters.
22" N-B-P Crank Slotter.

MISCELLANEOUS

30' No. 3 HILLES & JONES Plate Edge Planer.
30' x ⅞" NBP Bending Rolls, pyramid type.
No. 2 PRATT & WHITNEY Jig Borer with 22" x 44" table.

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AUTOMATICS, Baird, 6 spindle, M.D.
AUTOMATICS, Gridley, 9/16", ⅞ & 1¼" Mod. G
AUTOMATICS, Cone, 1¼, 2½ & 3½" 4 spdle
AUTOMATICS, Gridley, ¾, 1¼, 1⅝, 2¼" & 2⅝ Model F, M.D.
AUTOMATICS, Gridley, 2¼, 3¼, & 5¼" M.D.
AUTOMATICS, Cleveland 1¼, 1½, 2, 2½, 3½ & 4¾" Model A, M.D.
AUTOMATICS, Cleveland ⅞, 1¼, & 2" Mod. B
AUTOMATICS, Cleveland 3½" 4 spdle, Mod. K4
AUTOMATICS, Potter & Johnston #5a & 6a, M.D.
BULLARD 36" New Era Borg Mill, M.D.
CONOMATICS, 1½" & 1⅞"—8 spindle, M.D.
DRILLS, High Speed B. B. 1 to 6 spindles
GEAR HOBBERS, #3 & 12 Barber-Colman, M.D.
GEAR SHAPERS, #7 High Speed, M.D. & #6
GENERATOR, Gleason Spiral Bevel Gear 10"
GRINDERS, Brown & Sharpe #2 & 3 Universal
GRINDER, Brown & Sharpe #11 Plain, M.D.
GRINDER, Heald #72 Hydraulic, 2 M.D.
GRINDERS, Diamond Surface #2, M.D.
GRINDER, Norton 10"x36" Hydraulic, M.D.
GRINDERS, Landis Hydraulic, 6"x18", M.D.
GRINDERS, Pratt & Whitney 12" Vert. Surface
LATHES, Hendey, E.B.M. type, 14"x7' & 8' M.D.
LATHES, Hendey, 16"x6' & 8' & 18"x10' M.D.
LATHES, Reed-Prentice, 24"x12' G.H. M.D.
LATHES, Rockford, 18"x8' Geared Head, M.D.
LATHES, Turret, Warner & Swasey #4 G.H. M.D.
LATHES, Morey #3 G. H. Turret, M.D.
LATHES, Lo-Swing 4"x36" Seneca Falls
MILLING MACHINES, #2B Milw. & Vert. Hd.
MILLING MACHINES, Becker Vertical #5 & 6
MILLING MACHINES, Milwaukee #1B Plain & Universal #2 & 3B Plain, M.D.
PLANER, Ohio 42"x42"x10' One Head, M.D.
ROLL FORMING MACH. Yoder 6 spdle, M.D.
TAPPERS, Garvin #2 & 2X, M.D.

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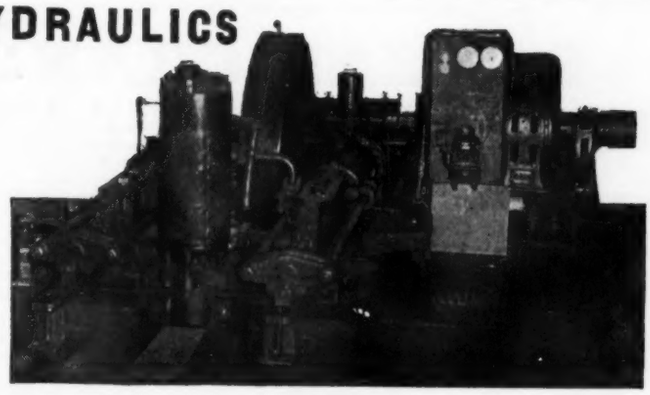

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DRILL RADIAL—FOSDICK 3¼', G.B., M.D.
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PLANER, METAL—WOODWARD & POWELL 30"x30"x8': 1 rail head, 1 side head.
TURRET LATHES—FOSTER No. 1-B Univ. inc. 2 Wrenches, Chucks, etc. M.D.; also W & S No. 2-A, Univ.
Available immediately—Also Many Other Tools
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100-ton BLISS Rack & Pinion Reducing Press, Type #263
Bolster Area FB x RL 32" x 30"
Stroke of Ram 12"-60"

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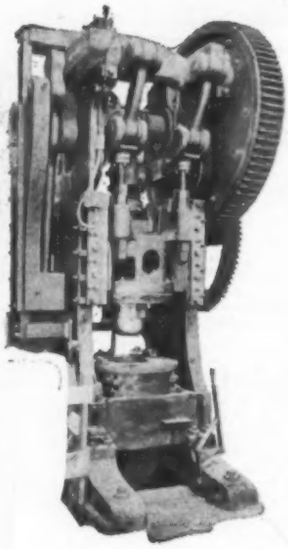

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LATHES

48"x24' Blocked to 60" Fifield, D.B.G.
46"x20' b.e. Niles, 2 carriages. G.H. M.D.
30"x14' Niles, Q.C. G.H. M.D.
30"x17" Blocked to 58" Houston. Q.C. M.D.
16"x6' Monarch, M.D. Late type
Many others from 7" to 98" swing. Niles, Ladge & Shipley, American, Monarch, Hendey, Leblond, South Bend, Logan, etc.

TURRET LATHES

4½" Bardons & Oliver. Bar feed. M.D.
#3, #4, #5, #2A, #3A, Warner & Swasey
Many others from ⅝" to 6" capacity

PLANERS

72"x72"x26' Sellers, 4 heads, M.D.
60"x60"x20' Gray, 4 heads. M.D.
40"x40"x12' Cincinnati, 2 heads
30"x30"x10' Powell, 2 heads. M.D.
36"x18' Dietrich & Harvey. Open Side. 2 heads. M.D.

BORING MILLS

2½", 3½", 4", 5" Horiz. Binsee, Universal, Bausch
24" to 10' Vertical Bullard, Niles, Cincinnati, Betts, etc.

SHAPERS

7" to 32" Rhodes, Smith & Mills, Gould & Eberhardt, Stockbridge, Walcott, etc.

HAMMERS, PRESSES & OTHER FORGING EQUIPMENT

¼" to 8" Upsetters. Ajax, Waterbury
Hydraulic Presses, 250 to 3000 tons. Wood, Watson-Stillman, HPM, Farnham, Oil Gear Co. etc.
Mechanical Power Presses, up to 2000 tons. Ferracute, Toledo, Bliss Waterbury, etc.
2000 ton HPM Turret Type Heading Press
#60½ Toledo Power Press, 1200 ton
#57 Toledo Press, 100 ton
#78½ Bliss Press
#5 Bliss Toggle Press
#5 & #6 Bliss Press, and many others
Steam Hammers from 100# to 35,000# Erie, Chambersburg, Niles, etc.
Many Waterbury-Farrell Presses

MISCELLANEOUS

New #510 Campbell Abrasive Cutter, 10"x12'
Bliss & Rafter Forming Rolls
Do-All Saws, Model V-26. M.D.
Many other special machines.

MILLERS

#2 SU Van Norman Universal, M.D.
#2, #3, #4 and #5 plain and Universal M.D. Cincinnati, Brown & Sharpe, Milwaukee, Hendey
#08 Cincinnati, Vertical, M.D.
#2, #3, #4, #5 Brown & Sharpe, Cinn., Bridgeport Vertical, M.D.
Brown & Sharpe, Cincinnati and Briggs Production Millers, M.D.

AUTOMATICS

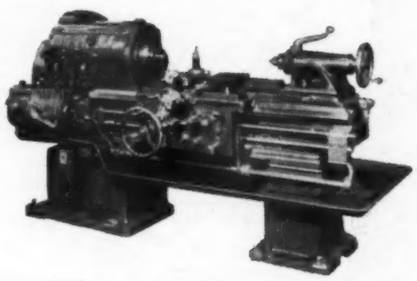
#00, #0, #2 Brown & Sharpe
2", 2½", 2¾" Cleveland, M.D.
Gridleys, New Britains—latest models

GRINDERS

Cylindrical, Plain and Universal, Landis, Norton, Brown & Sharpe and Cincinnati
#2 Cincinnati Centerless
Brown & Sharpe, Gallmeyer & Livingston, Cincinnati Universal Tool
#70 Heald Internal, M.D.

PUNCH, SHEARS

Adlerhurst, Excelsior, etc.



This is a partial list. Complete plants for sale or installed. Terms arranged.

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OVERHEAD CRANES

200 Ton Alliance 100' Span
175 Ton Morgan 54" Span
150 Ton Whiting 30' Span
80 Ton "American" 40'6" Span
75 Ton Alliance 37' Span
75 Ton Alliance 78' Span
50 Ton Cleveland 71'10½" Span
50 Ton Shaw 69'10" Span
40 Ton Alliance 82' Span
35 Ton Northern 22' Span
30 Ton Case 41' Span
30 Ton Morgan 30' Span
30 Ton Morgan 77' Span
30 Ton Niles 53'9" Span
30 Ton P & H 80' Span
30 Ton Reading 56' Span
25 Ton Bedford 50' Span
25 Ton Cleveland 108' Span
25 Ton P & H 70' Span
25 Ton Whiting 106' Span
25 Ton Whiting 82' Span
25 Ton Whiting 56' Span
20 Ton Alliance 77' Span
20 Ton Cleveland 65' Span
20 Ton Morgan 77' Span
20 Ton Northern 80' Span
20 Ton P & H 39'6" Span
20 Ton P & H 54'4" Span
20 Ton Shaw 76'4" Span
20 Ton Shepard Niles 49'8" Span
20 Ton Shaw 76'4" Span
15 Ton Alliance 50' Span
15 Ton Alliance 35' Span
15 Ton Cleveland 55'6" Span
15 Ton Cleveland 35' Span
15 Ton Morgan 77' Span
15 Ton Niles 32' Span
15 Ton Northern 53' Span
15 Ton Shaw 82' Span
15 Ton Shaw 77' Span
15 Ton Toledo 82' Span
15 Ton Whiting 74'8½" Span
15 Ton Whiting 71'10½" Span
12 Morgan 56' Span
10 Ton Alliance 53'8" Span
10 Ton Alliance 71'10" Span
10 Ton "American" 27' Span
10 Ton Cleveland 38' Span
10 Ton Cleveland 50' Span
10 Ton Emsco 30' Span
10 Ton Lane 50' Span
10 Ton Morgan 39'5" Span
10 Ton Morgan 77' Span
10 Ton P & H 57' Span
10 Ton P & H 78' Span
10 Ton P & H 87'6" Span
10 Ton Northern 34' Span
10 Ton P & H 49'10½" Span
10 Ton P & H 60' Span
10 Ton P & H 80' Span
10 Ton Shaw 68' Span
10 Ton Shaw 58' Span
10 Ton Shaw 88' Span
10 Ton Northern 71'10½" Span
7½ Ton Erie 70' Span
7½ Ton P & H 30'6" Span
7½ Ton Scullin 71'10½" Span
7½ Shepard 36' Span
6 Ton Shaw 23' Span
5 Ton "American" 10' Span
5 Ton Champion 37'6" Span
5 Ton Euclid
5 Ton Milwaukee 39'8" Span
5 Ton Milwaukee 66'9" Span
5 Ton Milwaukee 70' Span
5 Ton Northern 49'6" Span
5 Ton P & H 45' Span
5 Ton Shaw-Box 25' Span
5 Ton Shepard 40' Span
5 Ton Toledo 96' Span
5 Ton Whiting 80' Span
3 Ton P & H 46'4" Span
3 Ton Shaw 33" Span
3 Ton Whiting 57'3" Span
2 Ton Detroit 28' Span
2 Ton P & H 46'4" Span
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1½ Ton Cleveland 25' Span
1½ Ton P & H 34' Span
1 Ton Curtis 24' Span

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No. 59 TOLEDO, 350 Ton Capacity, straight side, double geared, 32 x 33" die space, 6" stroke, 12" adjustment. 25 Hp motors and controls, 15 yrs. old. No welds.

No. 29 TOLEDO, Knuckle Joint, 1500 Ton Capacity, Bolster, 40 x 39" bolster, distance bed to slide, stroke down adjustment up 22". Motors, Controls New 1942.

TOLEDO No. 666, Knuckle Joint Press, 1000 Ton Capacity, 37 x 21" bolster 2½" dist. bed to slide, stroke down adjustment up 18". New 1942 with all equipment.

HYDRAULIC 16' 8"x4' Flanging Press, R. D. Wood, 450 Ton Capacity, daylight 42", 27½" diameter main cylinder with all equipment. Exceptional price.

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8" x 108" Fitchburg Lo-Swing
16"x8' Lodge & Shipley Selective Geared Head
18"x8' Lodge & Shipley
36"x30' Lodae & Shipley Triple Geared Selective Head, two carriages

DRILLS

5' Fosdick Radial, motor drive

MILLING MACHINES

No. 2-H Milwaukee Vertical, latest type
No. 4-B Milwaukee Vertical
No. 4 Milwaukee Heavy Plain, Timken bearing
No. 118 Van Norman Production
26"x25"x12' Ingersoll Adjustable Rail
42"x36"x18' Ingersoll Adjustable Rail, four heads

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No. 50 Universal, 5" Bar, 60"x144" Table, Maximum Bar to Table 72", Maximum Bar to Outboard 120".
No. 32 Lucas, 3¾" Bar
No. 2 Rockford, 2-1/16" Bar

PLANERS

36"x36"x8' Woodward & Powell
60"x38"x8' Gray Spiral Geared

TURRET LATHES

No. 1-A Warner & Swasey, Timken Brg., Covered Ways
6.2" Denver, chucking machine
18" Libby, 3½" Hole in Spindle
No. 4, No. 6 Warner & Swasey

MISCELLANEOUS

No. 24-HS Gould & Eberhardt Gear Hobber
No. 72 Heald Internal Grinder
Oliver Ace Univ. Tool & Cutter Grinder
No. 27-MB Smalley-General Thread Miller
No. 6 Lees-Bradner Thread Miller
72" Colburn Vertical Boring Mill

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MACHINE TOOLS

Baldwin-Southwark Bending Rolls, ¾" capacity 32 ft. x 25"
#20 Bertsch Bending Rolls ¾", 20 ft. x 20" dia.
#3K Milwaukee Dial Type Vertical Miller
#36 Hanchett Surface Grinder 42" Chuck
#18 Blanchard Surface Grinder, 36" Chuck
8 ft. Carlton Radial Drill
3" UNIVERSAL Horizontal Boring Mill
12" x 30" "KK" Monarch Lathe

All latest type machines, new 1942 and '43

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Dexter 8880

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1—Ohio Mod. 5F-420, 5" bar, floor type, Horiz. Bor. Mill, M.D., AC Motor Drive, power rap. trav., 18 spin. speeds, range 6-200, taper in spin., Morse No. 7, long. trav. spin. 32", vert. trav. hed. 72", horiz. trav. hed. 120", new in 1941.

★ LATHES

1—Bridgeford 36" x 56', 15 speed, grd. hed., Eng. Lathe, M.D., AC elect. equip., power rap. trav. to carr., compound rest, 2 steady rests, sw. over bed 38", sw. over carr. 26", dist. betw. cens. 48'.
1—L. & S. 24" x 30' select. grd. hed., QCG, pan bed, Eng. Lathe, M.D., dist. betw. cens. 24', sw. over hed. 28½".
2—Niles Heavy Duty 32" x 35' Pl. Turn. Lathes, M.D., AC elect. equip., rap. trav. to carr., sw. over bed 34", over carr. 22", dist betw. cens. 24'6".
1—P. & W. 20" x 48" cens. Mod. B, 16 speed, grd. hed., motor in base, Eng. Lathe, sw. over bed 21¼".
1—Amer. 18" x 10', 8 speed, grd. hed., hi duty Eng. Lathes, M.D. sw. over bed 20½", dist. betw. cens. 67"

★ MILLERS

1—Cin. 5-48 Pl. Hydromatic Miller, long. tbl. feed 48", tbl. wkg. surf. 20" x 66½", max. dist. top tbl. cen. of arbor 13⅞", min. 5⅞", very lat. type, comp. with AC elect. equip., net. wght. 15,000 lbs.
3—B. & S. 3B Heavy Duty Pl. Mill. Machines, dbl. overarm type, AC motors in base, Ser. Nos. over 1630, tbl. wkg. surf. 55" x 18", range power feeds: long. 34", cross 12", vert. 20".
1—B. & S. No. 1A Univ. Miller, dbl. overarm type, AC motor in base, Timken bear. spin., tbl. wkg. surf. 40¾" x 11¼", range: long. 22", cross 8", vert. 18".
2—Cin. No. 2 Hi power Vert. Miller, M.D., SPD, tbl. wkg. surf. 47¼" x 12", range power feeds: 28" x 12" x 14".
1—B. & S. No. 2 Univ. Miller, tbl. wkg. surf. 45" x 10¾", range: long. 28", cross 10", vert. 18".

★ HORIZ. AND VERT. BORING MILLS

1—Lucas No. 32 Horiz. Bor. Mill, Knee Type, M.D., diam. bar 3¾", taper in bar, Morse No. 6, max. dist. spin. nose to act. support 72", tbl. wkg. surf 30" x 56".
1—Gisholt 52" Vert. Bor. and Turn. Mill, M.D., 54" diam. x 42" height under cross rail, comp. with right hand swiv. and left hand turret hed. on cross rail, horiz. and vert. rap. trav. to heds.

★ HORIZ. AND VERT. BORING MILLS

1—Betts 10'-16' Ext. Type Vert. Bor. & Turn. Mill, tbl. diam. 10', max. swing 16', hght. under cross rail 73", horiz. trav. of heds. 10', AC, grd., M.D., 2 swiv. heds. on cross rail.
1—Betts 10' Vert. Bor. & Turn. Mill, tbl. diam. 10', max. swing. 10'6", hght. under cross rail 60", horiz. trav. of heds. 72", 2 swiv. heds. on cross rail, AC grd., M.D.
1—Cin. 10' Vert. Bor. & Turn. Mill, max. swing 10'5", tbl. diam. 10', hght. under cross rail 72", horiz. trav. of heds. 72", 2 swiv. heds. on cross rail, power rap. trav., AC grd., M.D.
1—Colburn 48" Vert. Bor. Mill, M.D., capac. 49½" diam x 44" hght. under cross rail, 2 swiv. heds. on cross rail, power rap. trav.
1—Bullard 42" New Era Type Vert. Bor. and Turn. Mill, M.D., Ser. No. 10964, capac.: 44" diam., 33" high under cross rail, comp. with 3 jaw chuck tbl., side hed.
Niles 53" Heavy, M.D., 2 swiv. heds.
1—Landis No. 35 Floor Type Horiz. Bor. Mill, M.D., diam. bar 3½", Morse Taper No. 5, horiz. trav. of spin. 29", vert. trav. of hed 64", horiz. trav. of hed. 75", AC grd., M.D., reconditioned by mfctr., comp. with outboard support.
1—Univ. 3½ Knee Type Bor. Mill, 3½" bar, No. 6 Morse Taper, size of tbl. 30" x 48".

★ GRINDERS

1—Heald 72A3 Pl. Hyd. Int. Grinder, 2 Motor Drive, sw. over tbl. 15½", max. diam. hole ground 7½", max. stroke hed. 8⅝".
1—Heald 72A5 Pl. Hyd. Int. Grinder, M.D., 3 Motor Drive, Ser. No. over 4200, AC elect. equip., Red Hed. spin.
1—Heald 72A5 Hyd. Int. Grinder, Ser. No. over 21,700, very lat. type, comp. equip., 2 Red Hed. spins., workhead collet fix., AC elect. equip., extra tbl. lgth., capac. sw. over tbl. 28", sw. over bridge 60½", diam. and lgth. hole ground 8½", stand., max. grinding stroke 20⅝", extended bridge type.
2—Norton 18" x 96" Pl. Cyl. Grinders, self contained, M.D.

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Grinder, Cincinnati Universal 12x72
Grinder, Leach, M.D.
Grinder, Covel Surface No. 15, M.D.
Lathe, American 16"x8', M.D.
Mill, O-8 Cincinnati Vertical, M.D.
Mill, Index Vertical, M.D.
Mill, hand, Kento Owen No. 1, M.D.
Mill, Rockford Rigidmil, M.D.
Mill, Toledo Vertical No. 3V, M.D.
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Turret Lathe, No. 3 Bardons & Oliver full universal, extra tooling, M.D.
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Type G

1⅛" capacity, 36" Gap
M.D.

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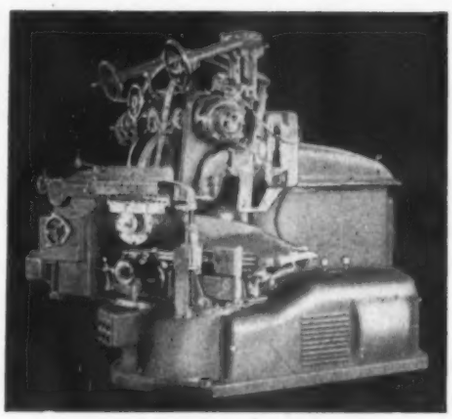

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Gear cutter, Gould & Eberhardt 42"
Grinder, Webster and Perks #1-¾ motor drive
22" Buffalo Pr. Fd. Motor Drive, New
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54" & 42" Bullard V.T.L.
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3½" bar Universal horizontal

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4' Carlton radial
4' Hammond radial
34 spdl. No. 30 Natco multiple
20 spdl. No. 4 Baush multiple, 2" spdl. No. 3 taper, hydraulic feed
24", No. 25 Foote Burt heavy
20" No. 2, 2 & 4 spdl. Colburn.
21" & 24" Cincinnati upright

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Nos. 16HS, 18H & 36H G. & E.
Nos. 7 & 61 Fellows shapers
Nos. 1 & 5A Lees Bradner hobbers
11" Gleason bevel generator
18" Gleason testers & lappers
No. 3 Barber Colman hob grinder

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12"x36", 16"x36" & 16"x72" Landis
10"x18", 10"'x36" & 10"x50" Norton
6"x20" No. 10 Brown & Sharpe
36", No. 18 Blanchard surface
16", No. 10 Blanchard surface
18" Arter rotary surface
14" Pratt & Whitney vert. surface
6"x18", No. 2 B. & S. surface
No. 2 Brown & Sharpe universal
No. 104 Rivett internal
No. 72A3 Heald Sizematic internal
53" & 72" Gardner horizontal disc
20", No. 120A Gardner opposed disc
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2000 lb. Chambersburg board drop
2000 lb. & 3000 lb. Billings & Spencer board drop

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60"x75'6" N-B-P double end
36"x16' Bridgeford geared head
16"x6' & 18"x8' American
14"x6', 16"x8' & 16"x10' Hendey
17"x6' Leblond grd. hd. Mfg.
14"x18" Monarch Magnamatic
14"x19" Fay automatic
15"x22½" Sundstrand auto. stub.
8" & 12" Sundstrand stub

MILLERS
Nos. 2B & 3B Milwaukee Plain
No. 5 Cincinnati High Duty Plain
No. 35 Ohio universal
No. 2 Cincinnati dial type vertical
No. 2 Brown & Sharpe vertical
No. 2½B Milwaukee vertical
No. 4—36 Cincinnati Hydromatic
30" x 48" Newton rotary

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6" Pratt & Whitney vertical shaper
16" & 24" G. & E. shapers
20" Ohio
32" Morton draw cut shaper
24"x24"x6' Ohio planer
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SAGINAW, MICH.

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No. 1 Cincinnati Acme Semi-Universal, m.d., chucking
No. 1L Gisholt, m.d., chucking, hardened ways
No. 1A Warner & Swasey Universal, m.d., chucking
No. 2 Cincinnati Acme Full Universal, m.d., chucking, latest
No. 2B Foster Universal, m.d., chucking
No. 2L Gisholt Universal, m.d., chucking, hardened ways
No. 2L Gisholt, long bed type, as above
No. 2L Gisholt Universal, m.d., chucking, hydraulic pre-selector, latest type
No. 2 Pratt & Whitney Shaver, m.d.
No. 2A Warner & Swasey Universal, m.d., chucking, Timken Bearings, hardened ways
No. 2A Warner & Swasey Universal, m.d., bar
No. 3 Cincinnati Acme Full Universal, m.d., chucking, latest
No. 3 Cincinnati Acme Full Universal, m.d., chucking
No. 3A Warner & Swasey Universal, m.d., chucking, electric operated chuck, Timken Bearings, covered ways, 6" hole, latest type
No. 3A Warner & Swasey as above, except 4½" hole
No. 3A Warner & Swasey, m.d., bar
No. 3A Warner & Swasey, m.d., chucking
No. 3L Gisholt, m.d., hardened ways, chucking
No. 4R Cincinnati Acme, m.d., bar
No. 4 Gisholt Universal, m.d., in base
No. 4L Gisholt, 9¼" hole, m.d., chucking, hardened ways
No. 4A Warner & Swasey, m.d., 7½" hole, chucking, Timken
No. 4 Warner & Swasey Universal, m.d., ram type, Timken, latest
No. 4 Warner & Swasey Plain, cone
2½x24" Jones & Lamson, m.d., bar
3x36" Jones & Lamson, m.d., chucking
3x36" Jones & Lamson 2 spindle, m.d., chucking
3¼" Cincinnati Acme, m.d., bar
3½x32" Jones & Lamson, m.d., chucking
3½x32" Jones & Lamson, m.d., bar
18" Libby Type A, chucking
20" Acme, cone
24" Gisholt, cone
26" Libby Type C, m.d., 7½" hole, chucking
28" Gisholt, cone
Woods Tilted Turret Model D, cone

SAWS
No. 3 and 8 Nutter & Barnes Cold
No. 5 and 6 Cochran-Bly Cold
5" Newton Cold
No. 138 Espen-Lucas Cold
No. 11½ Higley Cold

AUTOMATICS
4 spindle ⅞" Cleveland Model M, m.d.
4 spindle 2" Cleveland Model M, m.d.
4 spindle 2¼" Cleveland Model K, m.d.
2¼" Gridley Single Spindle, m.d.
2¾" Cleveland Model A, m.d.
2½" Cleveland Model A, m.d.
4¼" Cleveland Model A, m.d.
5¼" Cleveland Model A, m.d.
6" Cleveland Model A, m.d.
No. 6A Potter & Johnston, m.d.
No. 6C Potter & Johnston, m.d.
7⅝" Cleveland Model A, m.d.
14" Fay, Flander Type, m.d.
No. 22, 23, 33 New Britains

BORING MILLS—VERTICAL
24" Bullard Spiral Drive, m.d., with side head
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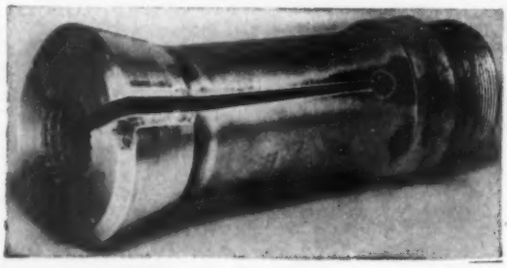

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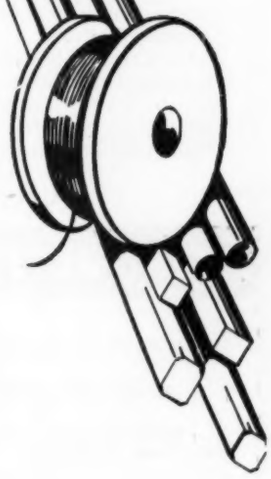

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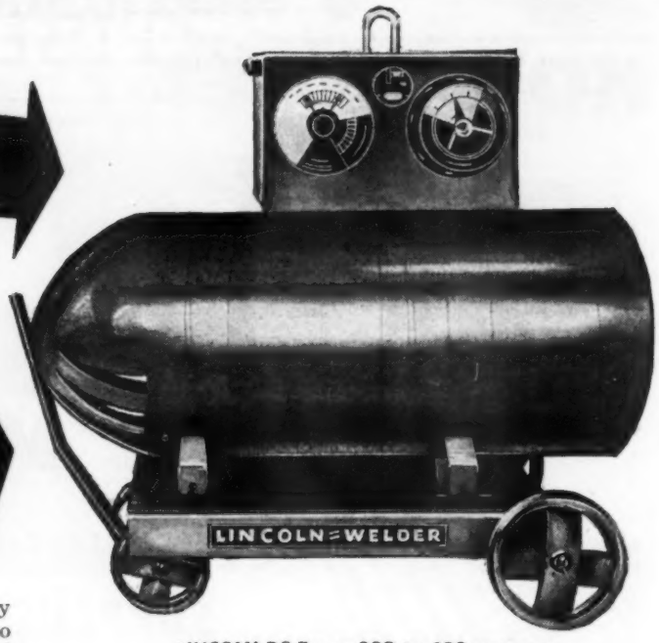

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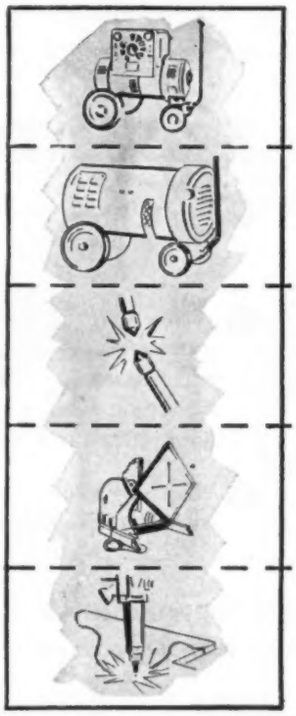

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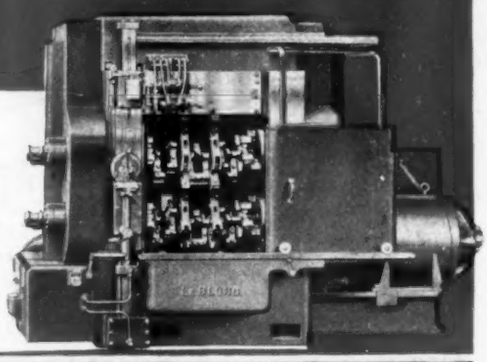
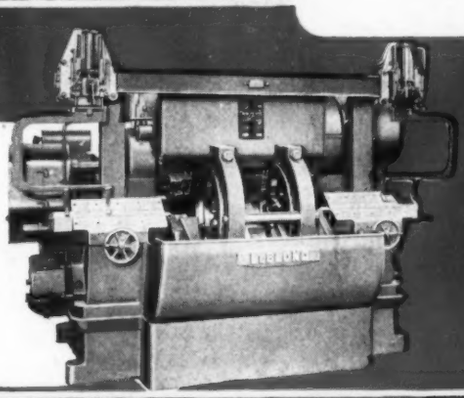
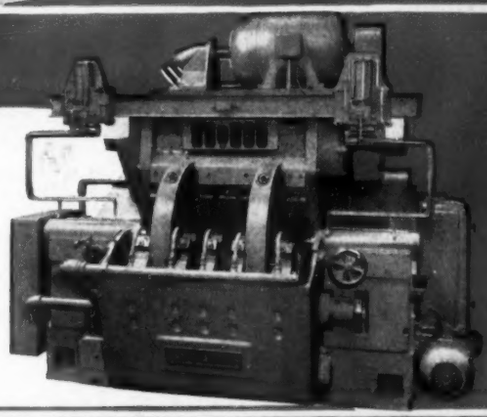
Le BLOND
AUTOMATIC CRANKSHAFT LATHES



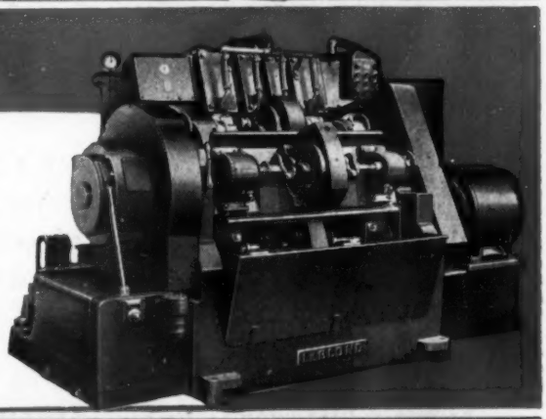
6AC 2 spindle, rough turns pin bearings on both spindles, or rough on one spindle, finish on the other.



7ACL Rough turns simultaneously on a single spindle all line bearings in one operation.



1LB Rough and finish turn line bearings at same chucking. Finish tools on separate cradle follow roughers immediately to reduce floor-to-floor time.



DM 4 Station index machine for finish turning all line bearings. Eliminates completely all rough grinding operations. Equipped with red and green control light system.

This new and improved line of LeBlond Automatic Crankshaft Lathes is in big demand wherever production requirements are high. Now more automatic and much faster, these truly remarkable lathes average 15 to 50 cranks per hour. See the complete line either under construction or in actual operation at our plant now.

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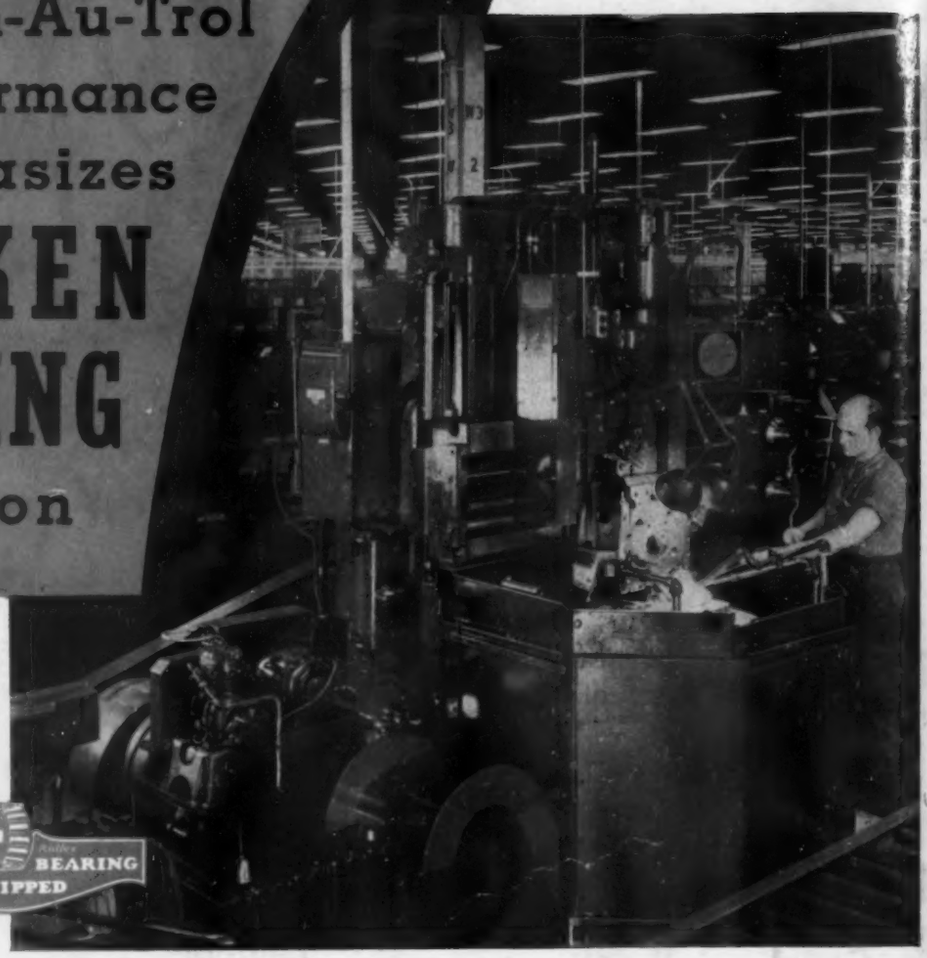
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

Bullard Man-Au-Trol Performance Emphasizes TIMKEN BEARING Precision



Bullard Cut Master Vertical Lathe with Man-Au-Trol Control operating in the plant of the Wright Aeronautical Corporation.

TIMKEN Tapered Roller BEARING EQUIPPED

When the Bullard Company developed the Man-Au-Trol Control, they selected the Bullard Cut Master Vertical Turret Lathe for the first application.

They did so because they knew the Cut Master possessed the great stamina necessary to assume the burden of complete and continuous automatic operation under heavy cutting loads.

They knew that the machine design was scientifically correct; that the construction assured the necessary accuracy and rigidity. And they realized that the presence of Timken Tapered Roller Bearings in the table and throughout the drive provided additional assurance of speedability, precision and endurance.

The tremendous ability of Bullard Man-Au-Trol equipped Cut Master Vertical Turret Lathes has been proved on war production and is being repeated in competitive peace-time manufacture where increased output and reduced cost are so vital.

Genuine Timken Bearings are identified by the trade-mark "TIMKEN". Make sure it appears on every bearing you use. The Timken Roller Bearing Company, Canton 6, Ohio.

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TAPERED ROLLER BEARINGS